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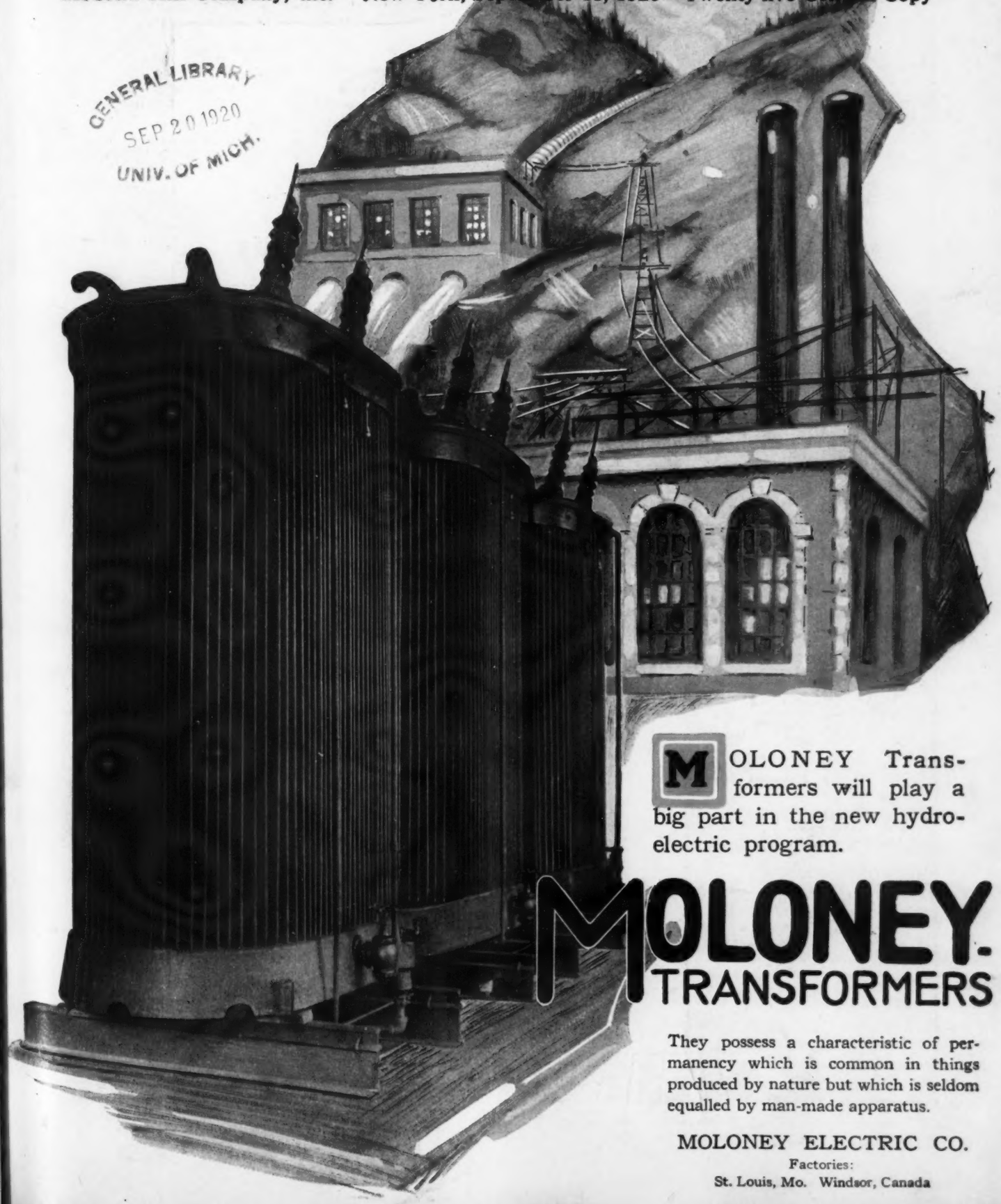

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Rural Service Controversies Unnecessary

IN SOME quarters there is a tendency toward controversy between the contractor-dealer, the small private-plant manufacturer and the central station over the rural service situation. This is as unfortunate as it is unnecessary, and it is to be hoped that the leaders of these three branches of the electrical industry will be far-sighted enough to squelch the tendency promptly wherever it appears. The field is so big that the private plant and the central station both have more than they can comfortably handle for years to come without coveting each other's field. Each will give service in its own field so long as the cost and reliability combined are better than the other can give, and no amount of controversy can change the fact. The contractor-dealer and the central station can ill afford to argue their respective rights. Both are factors in a vital service in the field and by a little careful planning co-operative schemes can be worked out that will benefit all.

Reliable Service First

RELIABILITY of service has been the glory of the central-station industry for many years. The time and money which have been expended to maintain a reputation for continuous energy supply are utterly unrealized by the public. All human institutions have their limitations, however, and there is food for thought in the recent loss of a large power contract by a central station which offered to furnish energy at a cost about 5 mills less per kilowatt-hour than the industrial plant concerned was attaining. The mill owners refused to sign because of irregularities in the operation of the local urban distribution system, contending that the annual saving in energy cost would count but little against the cost of a shutdown several times a year. Such experiences are not pleasant reading for central-station managers; but if they lead to the establishment of ring feeders for important industrial districts, or to the provision of emergency inter-substation tie lines or reserve capacity underground or overhead, they at least point the way toward the logical development of reliable service. The old adage against putting too many eggs in one basket applies also to industrial power feeders.

Distribution Losses and Fuel Scarcity

ONE compensation for high fuel costs to public utilities is the justification they accord to tests and investigations formerly restricted in scope because of operating exigencies, lack of time to canvass areas remote from headquarters and the expense of thorough analyses of elusive phenomena. Distribution system efficiency with a given investment in lines and transformers now "ties in" so closely with fuel supply and expense that it is no longer excusable to let such losses "run wild." If a kilowatt-hour at the consumer's meter requires 1.5 kw.-hr. at the station switchboard, the loss easily represents an extra pound of coal on a system enjoying high plant efficiency, and the present reward of reduced line and transformer losses is greater in dollars and cents than ever before in the history of central-station operation. Besides this, the conservation of fuel is sufficient incentive to set in motion keen-edged analyses of lost and unaccounted-for energy, even if the prices of heat units delivered to the turbo-generating sets were still at pre-war levels.

The High Cost of Money

IF THERE are still those who cannot understand that the public utilities must pay high rates of interest for the money required for expansion and for the maintenance of service on the high level that the people demand, then the loan that the French Republic has floated within the past few days in the United States should be a convincing eye opener. When the government of a great victorious nation, with its world-famous record for thrift and recuperative power, is in the market to sell bonds at 8 per cent, how can public utilities, with their restricted earnings, obtain money at a lower price? Yet until a higher rate of return is granted to them, as a matter both of elementary justice and public expediency, only the strongest among them can pay this price, and as a necessary consequence development is everywhere retarded or indefinitely postponed.

Co-operation of Electrical Interests

"CO-OPERACTION," rather than the more passive form, "co-operation," would be a good name for the spreading movement in the Far West which is intended to "promote the growth of the electrical industry in all its branches through the co-ordination of effort in the rendering of better electrical service to the public." Originating in California in 1917, the movement was composed of the four branches of the industry—manufacturers, contractor-dealers, jobbers, and central stations—united under the name of the California Electrical Co-operative Campaign. Following an unknown trail, the advisory committee, which is the executive and directing body, proceeded slowly and with the greatest caution to avoid missteps. One whole year was spent in procuring the adoption of the idea by the industry; next followed the employment of field men who visited the dealers and stimulated them to render better service, and after this an advertising representative and an architectural representative were employed who have been exceedingly active. The result of all this activity has been that far more is known by Californians about electricity, its uses and the possi-

bilities of its future application than in most other states. Moreover, the people have been most receptive to the plan and have actively assisted and been sympathetic in the solution of the local problems of the industry.

With the California example in mind the Northwest Electric Light & Power Association has formed the Northwest Electrical Service League, similar in purpose, organization and scope to the California plan. In British Columbia and in Ohio the plan is to be tried. With this rapid growth of a movement which has proved its value beyond doubt the question arises as to its ultimate expansion, which already has taken the form of a national program. The experience of the California committee favors isolated group control without many set rules of conduct. Because of its purposes the plan requires intimate dealing with a wide variety of local subjects; so that while national in scope its control must take into consideration first and last its direct local appeal.

The Emergency Plant at Niagara

ONE of the greatest feats of war-time effort, the building of the new 100,000-hp. plant at Niagara Falls, is described in our columns this week by the vice-president and chief engineer of the Niagara Falls Power Company, John L. Harper, and his right-hand men. To build a station of this capacity is a distinguished task under any circumstances; to carry it through with equipment ordered from various sources without detailed and homogeneous specifications and at top speed is an achievement that reflects particular credit on both the company engineers and the manufacturers who put their best talent and energy into meeting the emergency. The immediate work at hand was to put on duty as speedily and efficiently as possible all the remaining water available at Niagara under the treaty with Great Britain. The War Department called for plans and finally adopted one of those presented by the Hydraulic Power Company of Niagara, one of the three large companies then utilizing the power of the great cataract. The first step toward unified action was the actual consolidation of these three, and early in May, 1918, orders were given to proceed.

The work carried out involved the deepening of the intake from the Niagara River, improved protection from ice, deepening the hydraulic canal through the city, the excavation of three slope tunnels from the forebay to the brink of the river, and finally the building of the hydro-electric plant itself as an extension of Station No. 3 of the Hydraulic Power Company system. Three hydro-electric units of uniform size, aggregating 100,000 hp., were ordered—one complete from the Allis-Chalmers, one generator each from the General Electric Company and the Westinghouse company, and the two corresponding turbines from the I. P. Morris Company. To the hearty co-operation of these great works the prompt success of the enterprise is due. Without specific guarantees of efficiency and with a free hand in design, all co-operated in providing similarity of exterior appearance and inherent characteristics and turned out a machine representing the highest developments of the art. Each unit has proved capable of continuous operation at 40,000 hp., at present the record rating for a single hydro-electric unit. For the several wheels it appears that the hydraulic efficiency will reach fully 93 per cent, while the efficiency reckoned from headwater to switchboard will be more than 90 per cent. Rush work though it was, the results have been of the most distinguished character. The first unit was actually put into service in nineteen months and this time could have been shortened by about five months had the work not been slowed down after the armistice was signed.

The greatest opportunity for improvement in efficiency has in late years been in the turbines and their accessories. Electrical generator design long ago reached a point where in large units to operate under given conditions variations in efficiency are likely to be measured only in tenths of 1 per cent. The whole increase of the last decade is almost exclusively due to betterment of the hydraulic end of the unit, chiefly in the reduction of frictional and eddy losses. In the Niagara work great care was taken to keep down the velocities of flow in the path to and from the wheels. The former portion of the task was carried out along lines somewhat familiar. The latter rested upon the improvements in draft-tube practice, to which are in no small measure due the remarkable results attained. Careful design and finished execution of the wheels themselves did the rest.

The net result has been an efficiency to the switchboard not likely to be raised materially. The setting of the units involved structural problems on account of the great weights dealt with, but the conditions appear to have been most successfully met in every particular. In the general plan of hydraulic work the matter of winter water supply in defiance of ice came to the front, but fortunately more than a score of years' experience with local conditions furnished the requisite data for the solution. A wide and deep channel was cut outward to the normal limit of ice in the stream and then extended upstream. Shoreward a screen of concrete piers and booms was built in double rank, keeping the float ice out of the intake channel. Our heartiest congratulations are due on the energy and skill which have so promptly made available this great increase in the practical usefulness of the cataract.

Construction Accounting Needs Attention

ANALYSIS of property accounts that reveals serious errors is an all too common experience when it is necessary to dig into past records. It is not uncommon in an attempt to ascertain the cost of a specific property unit to find general property accounts disregarded entirely and an engineer's estimate of what the unit should have cost substituted. Such a situation is due to inexcusable carelessness in the building up of accounting systems, in that those responsible have specified the ultimate result without proper consideration of the means for attaining that result. Elsewhere in this issue will be found a discussion of construction accounting and its relation to the general property accounts of the utility. An accounting system that does not provide proper methods of securing ultimate results by a carefully planned construction accounting system is a source of weakness, particularly when dealings with commissions must be had. A clear, indisputable record of the actual cost of property units may be the subject of differences in opinion as to whether costs have been kept to the lowest possible limit, but as compared to an

estimate in which opinions as to what costs should be are the guiding factor the actual cost record is a tower of strength. Actual investments are a vital factor in determining rates, and utilities cannot afford to handicap themselves by carelessness and short cuts in construction accounting methods that cast doubt on the accuracy of their general property records.

Elements of Sound Power Developments

PUBLIC utilities, for their own salvation if for no other reason, should take it upon themselves to instruct the public regarding the elements of sound water-power development. They should point out to the layman that it is not sufficient merely to have potential water power. It must be technically feasible to develop the power economically, and there must be a market available within reasonable distance. Consideration must be given to variations in water flow during the year. The minimum flow limits the power which can be developed unless storage or a reserve steam plant is provided. The cost of these must logically be charged against the water-power development. In addition it should be emphasized that subsoil formation must have careful attention because otherwise the water in storage may leak through or the dam may be washed out, while if the site is in rugged country, away from transportation, the construction may be impracticable or prohibitively expensive.

Last but not least, attention should be called to the necessity of a market within economical transmission distance. To have a possible market is not enough. One must exist. It is not good engineering to pay fixed charges on the whole development and have a demand for only a part of the power. Furthermore, there is little economy, if any, in developing a water power for only part of the ultimate output, since the first investment is the heaviest.

Arithmetic and Rate Fixing

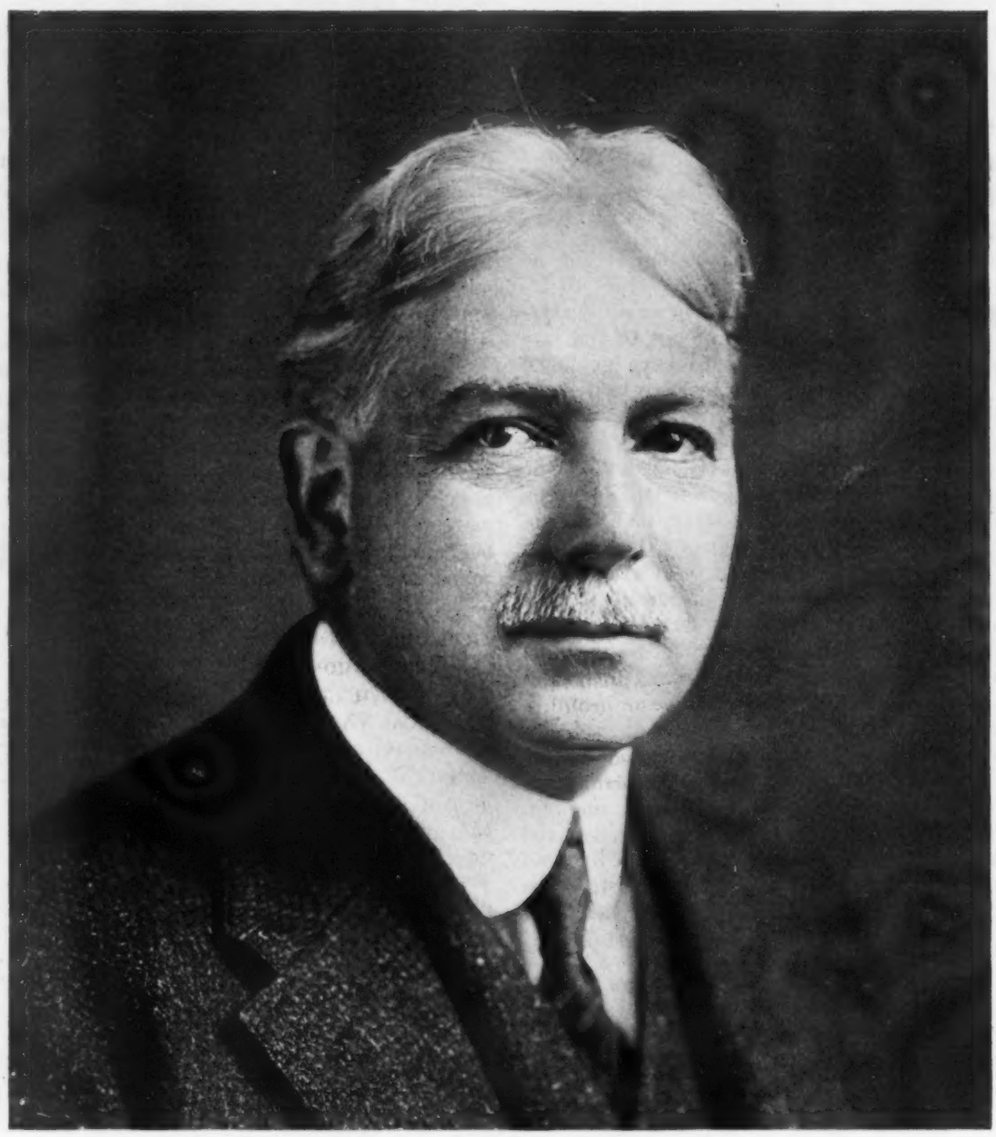
A DISINCLINATION to prepare in brief form a thorough computation demonstrating the estimated possibilities and justice of questioned rates is natural to a central-station manager who realizes that judgment plays a leading part in the determination of rates by the regulating commission. In trying to ascertain the cost of a particular service certain operating expenses can be set down with fair accuracy, and sometimes initial plant and development costs are available to enable the rate base to be found to a substantial percentage of its total. Beyond the zone of definite figures, however, lies a sort of No Man's Land of uncertainty across which the way must be picked according to the wisdom and judgment of those who are attacking the problem of conquering the combined tangibles and intangibles of rate determination. It is because of the latitude involved in passing upon cost exhibits and estimates of rate equity that it often seems not worth the effort to set down the arithmetic of rate making. Such an attitude overlooks the value of computations from the standpoints of suggestion and of open-handed publicity. The commission may modify the computations and it may make sweeping changes in the assumptions and allocations in the company's efforts to vindicate a particular schedule; but the possibility of this ought not to deter as complete a demonstration as possible of how the rate base is attained and the charges thereon are supported. Rate fixing is far more than an arithmetical problem; but it demands arithmetical computations in order that the conclusions of both experience and assumption may be properly attained. Assumptions as to the rate of depreciation, period of cost during which investment should be computed, the future price of money and other things cannot be picked off an adding machine like the items of a grocery bill; but these must fall into line in the grand assault upon the factors involved in a reasonable rate, and if the company omits them, the opposition and the commission must make their own. A consistent, straightforward setting forth of the reasons why rates in particular cases are just to a company and its customers is as useful in the establishment of a rate in the face of opposition or ignorance of the facts as is the supporting artillery fire in an infantry advance. Failure to set forth in arithmetical form the asserted equity of a stated rate under critical or searching fire puts the operating company at a decided disadvantage in proceedings where the best judgment of all concerned is needed to reach a sound decision.

Electromagnetism One Hundred Years Ago

BY A FORTUNATE coincidence of dates, the ELECTRICAL WORLD is enabled this week to celebrate with its readers a memorable day, the one hundredth anniversary of the discovery of electromagnetism. It might be said that the electromagnetic theory had its inception in the announcement of his discoveries by Oersted on July 21, 1820, and that it was fully formulated and launched by Ampère on Sept. 18, 1820, exactly one hundred years before the date of this issue of the ELECTRICAL WORLD. On another page may be found a series of letters recalling to mind the wonderful genius of the men who worked out electromagnetic relations in the face of every obstacle. These early scientists had practically no facts upon which to build, and there existed no little misconception, prejudice and confusion which they had to overcome; but the facts established by Oersted and formulated by Ampère have become the underlying law of electrical science.

It is interesting to note that Oersted and Ampère were both college professors, as were many of the others whose contributions added materially to the work of these two. And in looking over the names of the men who have contributed letters to this centennial celebration, men distinguished in electrical science in our day, it may be observed that most of them also are, or at least were, college professors. The occasion should not be allowed to pass, therefore, without calling attention to the great importance of the work of purely scientific investigation even now going on in our university laboratories as well as in many progressive industries. By all means let this work be directed along useful lines where possible; yet there is still the necessity for the exploration of new ground which may not now offer promise of fertility but which may some day bring forth a tremendous harvest, as in the case of the work of Oersted and Ampère.

Appreciation of the achievements of these pioneers should induce a healthy respect for the work of our own investigators and result in increased encouragement of their efforts.



John Lyell Harper

The engineering genius back of the power developments at Niagara Falls whose resourcefulness has made it possible to use Niagara's waters without marring its beauty

THE most famous power development in this country, from the standpoint both of the engineering it represents and the service it renders to industry, is situated at Niagara Falls. This work stands as a monument to the genius of John Lyell Harper, whose name is as inseparably linked with it as is the wealth of the well-known Schoellkopf family that has made that development possible. It is due wholly to Mr. Harper's vision and engineering judgment that there stands today on the American side a mammoth station of 250,000 hp. where in 1902 there was a total rating of only 14,000 hp. The recent addition of 100,000 hp. which is described in this issue, built as a war need in record time and at a remarkably low cost, is the latest product of his engineering ability. In developing Niagara Falls Mr. Harper has devoted much study to ways and means to preserve the scenic beauty of the great cataract.

Besides his responsibilities as vice-president and chief engineer of the Niagara Falls Power Company, Mr. Harper has made scientific investigations of the applications of electric service in the electrochemical and electrometallurgical industries at Niagara Falls and has developed and patented several electric furnaces. In all his work he has maintained high engineering standards and ideals and has done much to stimulate manufacturers to turn out the highest grade of product rather than simply to meet specifications. One outstanding accomplishment was increasing the over-all plant efficiency from 65 to 90 per cent.

Mr. Harper was born at Harpersfield, N. Y., in 1873 and was graduated from Cornell University with the class of 1897. He first took up practical work with the Union Electric Company at Seattle, Wash. A year later he became associated with the Twin City Rapid Transit Company and the St. Croix Power Company of Wisconsin and spent three years in central-station design and operation. In 1902 he joined the engineering staff of the Hydraulic Power & Manufacturing Company at Niagara Falls, becoming its chief engineer two years later. Under the stress of war needs, the federal authorities brought about the merger of the power companies at Niagara Falls, and it is a fitting tribute to Mr. Harper's vision and ability that the developments of the consolidated companies were placed in his hands and that in 1919 the responsibility of vice-president was added. Mr. Harper works with his head, his heart and his hands, and, great as his past achievements have been, it is safe to say that his labors at Niagara Falls have only begun.

Niagara Falls 100,000-Hp. Development*

Although Built Under the Stress of War-time Conditions, the Niagara Falls Power Company's New 100,000-Hp. Extension Embodies the Latest Word in Hydraulic and Electrical Development — Reliability of Operation and Maximum Efficiency Given Chief Consideration

By JOHN L. HARPER
Vice-president and Chief Engineer Niagara Falls Power Company

WHEN the war came and shells and guns and ships and motor trucks and phosphorus and gas were found vital to the existence of the nation and its allies, our government functioned through representatives whose minds appreciated values at Niagara other than in thundering vibrations and clouds of spray, wonderful as both may be in times of peace. There was no hesitation on the part of the directors of the war in first restricting Niagara power to the manufacture of basic materials and then demanding further development of power so that the production of these materials might be increased. All parties interested in power development at Niagara Falls were asked to submit plans and propositions for a "rush" development of the remaining water available for diversion under the treaty with Great Britain. From these competitive plans one of those presented by the Hydraulic Power Company of Niagara Falls was approved by the War Department as that which would produce the largest amount of power in the shortest time and at the same time be a proper and efficient power development after the stress of war had passed.

The plan approved by the War Department required the use of all the water to which the various operating companies at Niagara Falls had proprietary rights. To unify these rights it was obviously the easiest way to consolidate all the power companies, and upon suggestion of the War Department such consolidation was undertaken. The Niagara Falls Power Company, Hydraulic Power Company of Niagara Falls and Cliff Electrical Distributing Company were consolidated under the name of the Niagara Falls Power Company, the control and management of the consolidated company resting in the former owners of the Hydraulic Power Company.

Scope of Development

In the early part of May, 1918, authority was received from the Secretary of War with orders to proceed with the development in accordance with the approved plan under the supervision of an officer of the Corps of Engineers. The scope of the work carried out under this plan included the deepening of the intake from the Niagara River, the development and installation of improved ice-deflecting booms, the deepening of the Hydraulic Canal through the city of Niagara Falls, the construction of a new forebay, and three slope tunnels for taking the water from the forebay to the edge of the river in the middle basin, where the power plant was constructed as an extension to Station No. 3, the former Hydraulic company's plant, now known as the Hydraulic plant.

Three hydro-electric units were designed, to be equal in size and to have a combined output at the highest efficiency of 100,000 hp. In view of the peculiar conditions that existed on account of the war, and in order to secure quick delivery, the contracts for the manufacture of the waterwheels and generators were distributed as follows: One complete hydro-electric

*First installment of a symposium on the 100,000-hp. extension to Station No. 3 of the Niagara Falls Power Company.

unit to the Allis-Chalmers Manufacturing Company, two waterwheels to the I. P. Morris department of the William Cramp & Sons Ship & Engine Building Company, one generator to the General Electric Company and one generator to the Westinghouse Electric & Manufacturing Company.

On account of the urgent need of this work by the War Department, A-1 priority orders were given by it to the builders for the obtaining of materials necessary for manufacture and construction, and sympathetic and effective assistance was rendered by all government departments in carrying out this work.

The contracts for the building of these waterwheels and generators were not placed on a basis of competitive prices, nor were specific guarantees of efficiencies exacted. As all of the power companies on the American side were to become one, it was deemed advisable to allow all of the larger manufacturers of this class of apparatus to have an opportunity to show what they could do in the production of these new units, which were expected to be the last word in hydro-electric design. All of the manufacturing companies approached their tasks with enthusiasm and patriotic endeavor to produce the best, and now, when all three of these units are in operation, it is impossible to say that any better apparatus could have been constructed under the most minute specifications and inspection. All of these companies not only co-operated fully with the War Department and the power company in meeting with dispatch the emergency requirements of rush production, but at the same time gave such careful and efficient attention to the whole design and manufacture that the resulting machinery was of the highest class known to the art. Although the machines are of different manufacture, the builders co-operated to produce similarity in their exteriors, thus giving a uniform and pleasing appearance to the station.

Although the official efficiency tests have not as yet been completed, it is apparent from those already made that the hydraulic efficiency will equal or slightly exceed 93 per cent, and that the efficiency from forebay to the switchboard will be over 90 per cent. The units have each demonstrated their ability to operate continuously at 40,000 hp., although the combined operating station output is considered as 100,000 hp.

These are at present the largest hydro-electric units in the world, and it is a subject for pride in our American manufacturers that these four companies, as well as those manufacturing valves, bearings, etc, have mutually taken this step in advance without failure in any particular.

The construction work was carried out in the face of unusual obstacles in procuring both labor and materials, yet in all cases the manufacturers of the principal parts of the apparatus lived up to their agreements as to time of completion. If the construction and installation had been pushed with the same vigor after the armistice was signed as it was before, it is probable that the first unit would have been put in operation in fourteen months after the word was given by the Secretary of War, but, under the reduced schedule as to progress, the first unit was not put in operation until nineteen months after authority was received to proceed.

The writer wishes to express his appreciation of the loyalty and efficiency of the engineering and construction staffs of the Niagara Falls Power Company, which were obliged to make the plans at the same time that the work was in progress, and whose ability and efficiency may be measured by the fact that in spending about $8,000,000 less than $1,000 was wasted in changes

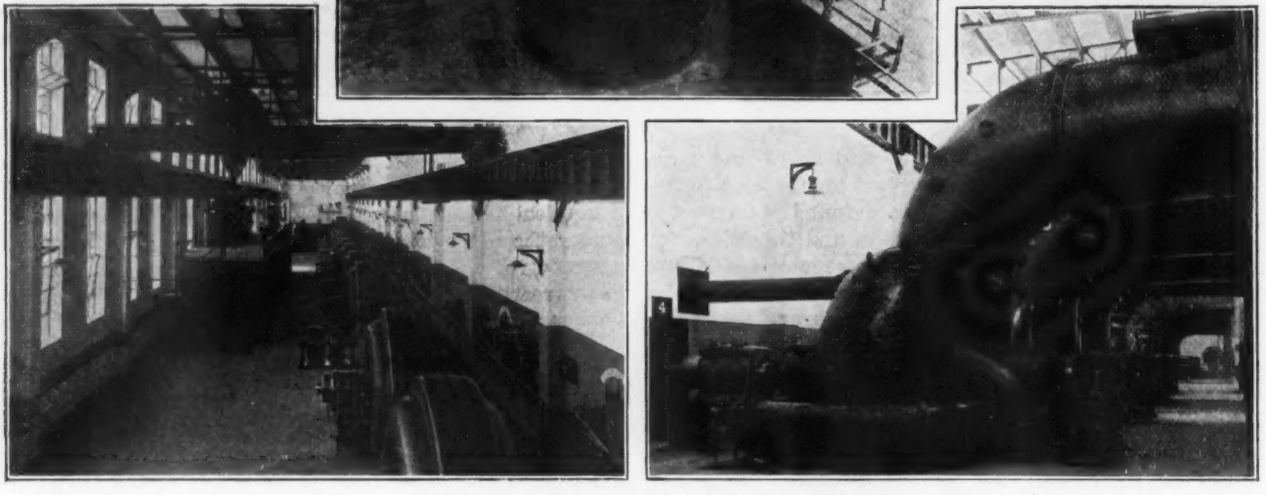


FIG. 1—THE NEW AND OLD AT NIAGARA NO. 3

At the top are the three new generators rated at 35,000 kw. but capable of developing 40,000 kw. Their magnitude is indicated by comparing them with the desk appearing just above the top of the nearby unit. In the lower left-hand view is a long hall of horizontal shaft generators driven by waterwheels on the opposite side of the wall. These wheels are shown in the right-hand view. All of these units are in the Hydraulic Plant No. 3, which is shown in Fig. 5.

of plans. In addition to those engineers who have contributed to this symposium and installments which are to follow it is desired to express appreciation of the efficiency and co-operation of Ross R. Coddington, general superintendent, whose aggressive and efficient personal direction of the construction work made possible the balance and speed with which the various parts of the work were completed in proper co-ordination without sacrifice of quality or perfection in workmanship. Also Benjamin F. Lee, operating superintendent, whose resourcefulness and experience overcame all obstacles in operating the older plants of the system during the interference of both mechanical and electrical construction by the building of this extension.

General Engineering Problems Involved in the Development

Steps Taken to Assure Ample Water in Winter—Vertical Units Allow for Large Fluctuations in Tailwater Elevation—Study of Draft Tube Requirements

BY GEORGE R. SHEPARD

Assistant chief engineer Niagara Falls Power Company

AT THE time of the United States' entry into the war the Niagara Falls Power Company was entitled to draw from the Niagara River not to exceed 8,600 cubic-foot-seconds (240.8 cu.m. per second) and the Hydraulic Power Company was entitled to 6,500 cubic-foot-seconds (182 cu.m. per second). Very soon thereafter the need for power for war industries became so great that the War Department issued additional permits to both companies to cover the maximum output of the apparatus

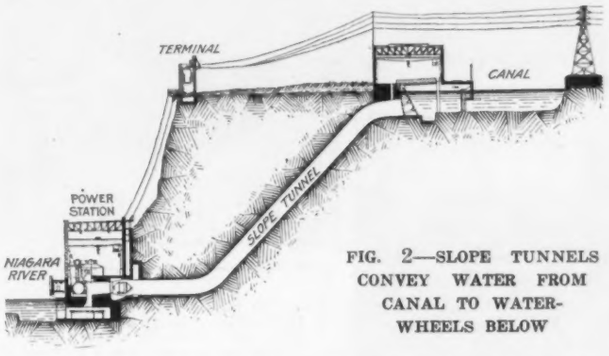


FIG. 2—SLOPE TUNNELS CONVEY WATER FROM CANAL TO WATER-WHEELS BELOW

then installed. After the merger of the two companies and the agreement of the consolidated company to proceed immediately with a new development, a permit was issued for the entire amount of water available at Niagara Falls under the treaty, or 19,500 cubic-foot-seconds (546 cu.m. per second). Fifteen thousand one hundred second-feet (422.8 cu.m. per second) of this could be utilized by the normal capacity of the existing plants, leaving a balance of 4,400 cubic-foot-seconds (123 cu.m. per second) for the new development.

The total diversion can be obtained continuously because the Niagara River is the natural outlet of a drainage area of about 300,000 square miles (750,000 sq.km.), making the variation of the river flow from normal comparatively small, although there is a small seasonal variation. Variations of greater amount are caused by winds and occasionally by ice jams but last only for a short period of time. Therefore, except for severe ice conditions, the river fluctuations are not an operating problem, nor will they be until there is considerably more diversion.

The combination of extremely uniform flow and a fixed maximum diversion limit placed the company in a position where load factor was, as it still is, the controlling economic element. Unless the company maintains continuously its maximum diversion, there is a certain

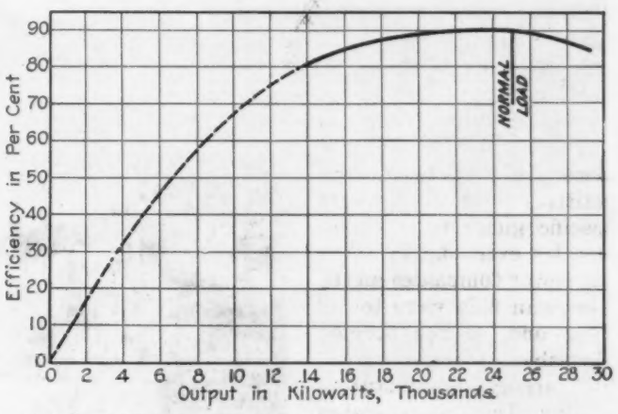


FIG. 3—AVERAGE OVER-ALL HYDRAULIC PLANT EFFICIENCY AT DIFFERENT OUTPUTS

amount of energy absolutely lost not only to the company but to the country in general. If the Niagara load were combined with a steam plant, economy would require a reversal of the usual custom and a supply of the base load by the hydraulic plants and the peak by the steam plant. It seems therefore that Niagara power is economically suited for industries requiring a continuous twenty-four-hour load and that any service with an inherently low load factor represents an economic waste.

The dire necessity for extreme speed in the development of power to meet the war demand for electrochemical products decided the power company in utilizing as far as possible its existing development to facilitate the new development.

The existing development consisted of a surface canal 100 ft. wide and 15 ft. deep, passing from the upper

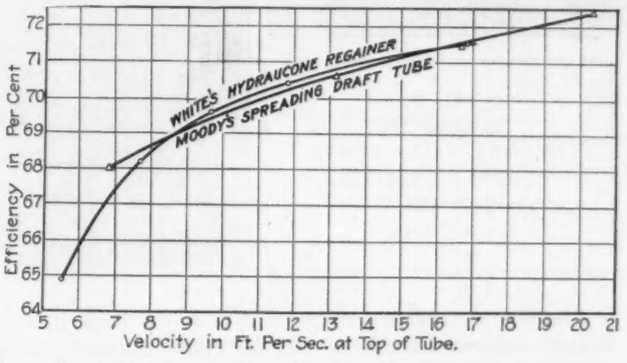


FIG. 4—EFFICIENCIES OF TWO TYPES OF DRAFT TUBES USED AT DIFFERENT RATES OF DISCHARGE

river through the city about 5,000 ft. to a forebay overlooking the high bank of the lower Niagara River. At this point is Station No. 3, which took water from the canal through thirteen steel penstocks built outside of the cliff, though now concealed from view by a face wall.

The water was delivered under a 212-ft. head to thirteen horizontal turbines of 10,000 hp. each.

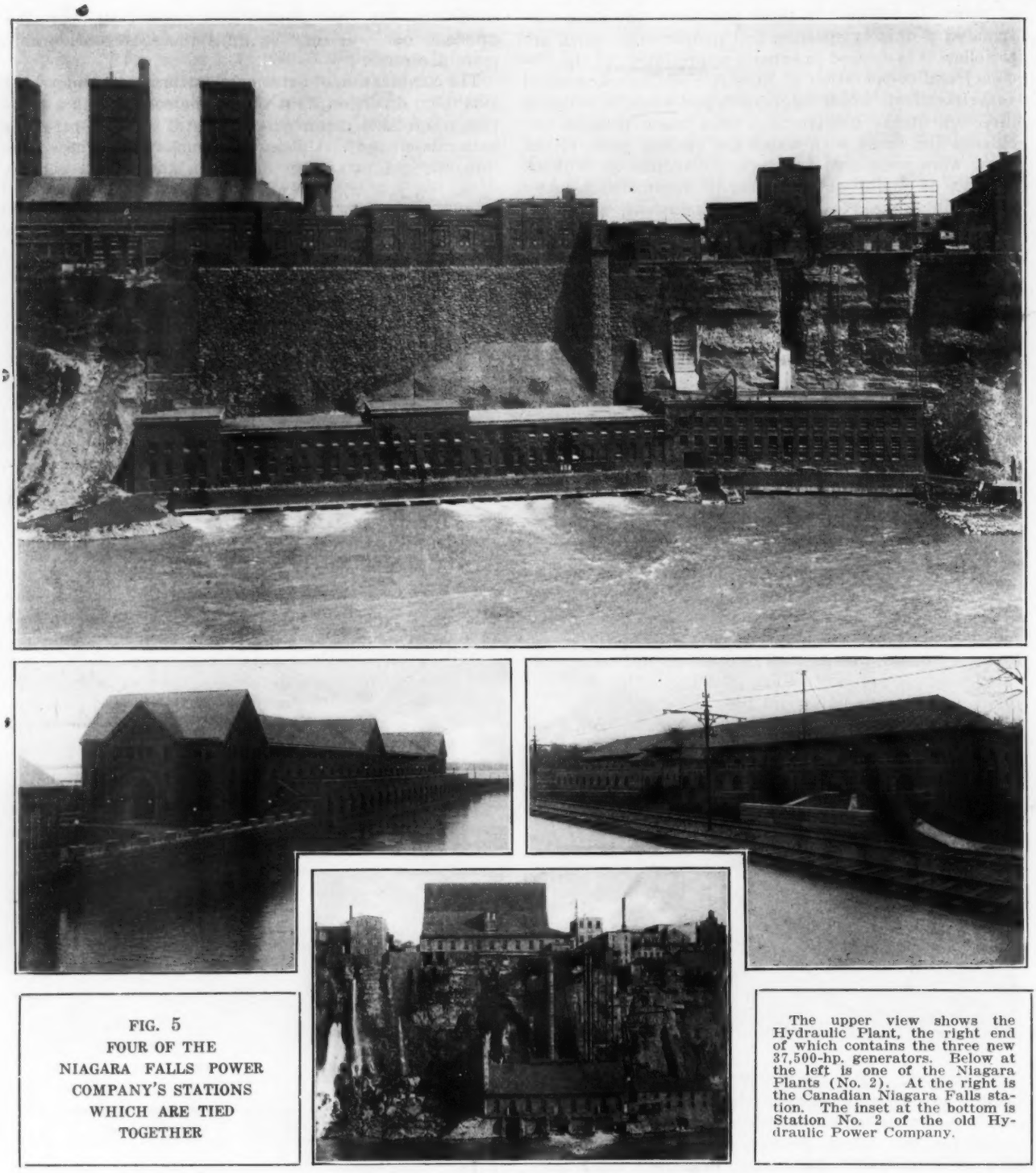


FIG. 5
FOUR OF THE
NIAGARA FALLS POWER
COMPANY'S STATIONS
WHICH ARE TIED
TOGETHER

The upper view shows the Hydraulic Plant, the right end of which contains the three new 37,500-hp. generators. Below at the left is one of the Niagara Plants (No. 2). At the right is the Canadian Niagara Falls station. The inset at the bottom is Station No. 2 of the old Hydraulic Power Company.

The new extension to Station No. 3 was built immediately upstream from the existing plant. It consists of three 15½ ft. penstocks opening directly from the canal through a new forebay and passing through the limestone rock at a general slope of 45 deg. to the power house built as an extension of the old power house just above the lower river level. Here are installed three vertical units of 37,500 hp. each. Along the river side of the building at the level of the thrust bearing deck of the generators is the operating gallery.

At the point where the power company takes its water, the Niagara River is a broad stream, and the main channel is near the Canadian side. Between the main channel and the company's intakes there is a broad stretch of water intersected with submerged reefs and ridges and having a depth of from 4 ft. to 14 ft. (1.2 m. to 4.2 m.) at the mean stage of water elevation.

The stream never freezes solidly over its entire width, and the outer line of the solid shore ice remains in approximately the same place from year to year.

One engineering problem involved in the new development was to obtain the normal supply of water for the power plants during the winter period of low temperatures and severe ice conditions. The company's engineers had studied this problem for twenty years and were prepared with the proper solution. A deep chan-

nel about 200 ft. (60 m.) in width was dug from the company's inlet outward to the edge of the ice line. Commencing at the intersection of this channel with the ice line, a series of piers were built, running upstream in the general direction of the ice line but gradually working in toward the shore. Floating booms were placed from pier to pier. About half way between this row of piers and the shore another row was placed, extending in the same direction and supporting floating booms in the same manner as the outer row. See Fig. 10.

This system has been in operation through one exceptionally severe winter and has proved entirely satisfactory. The booms have kept out the ice floating down the river, and what small amounts actually formed inside the booms have been broken up from time to time in small quantities by the company's ice-breaking tugs and allowed to flow down the canal, where they were disposed of through the spillway gates.

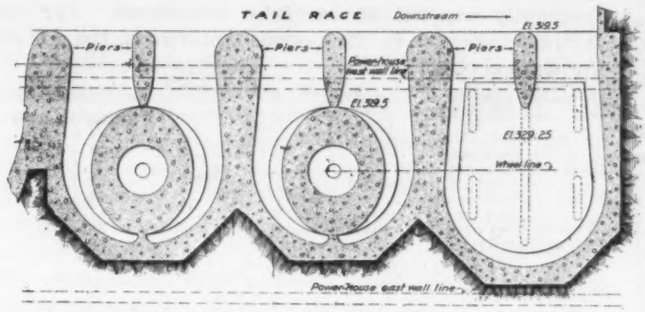


FIG. 6—HORIZONTAL CROSS SECTION THROUGH THE TWO TYPES OF DRAFT TUBES EMPLOYED

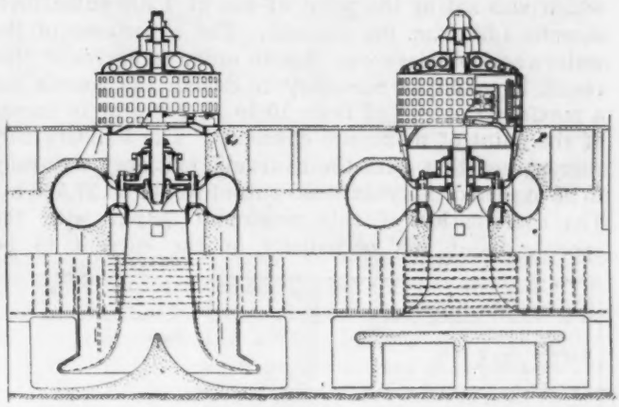


FIG. 7—CROSS SECTIONS THROUGH TWO TYPES OF WATER-WHEELS USED SHOW DIFFERENCES IN DRAFT TUBES

Prior to this extension the canal was 100 ft. (30 m.) in width and varied in depth at the high-water period of the year from 15 ft. to 22 ft. (4.5 m. to 6.6 m.). In order to get sufficient water through the canal to run the added equipment it was necessary to enlarge the cross section. The canal runs through the most thickly settled portion of the city, and it was impossible to acquire property rights to widen the canal, so that the only possible thing to do was to deepen it. Drilling, blasting and dredging seemed to be the only practical method, although the proximity of large buildings introduced an element of risk which made extreme caution necessary.

The canal is spanned by eight bridges, having a clearance above the water surface of from 6 ft. to 15 ft. (1.8 m. to 4.5 m.), which prohibited the use of the ordinary type of dredge, but the long experience of the company's general superintendent with this class of work had evolved a dredge model that accomplished the work without any undue difficulty.

SELECTION OF WHEELS

The experience of the power company in former developments led to the adoption in 1906 of the horizontal-shaft units for the plant then being designed. However, in 1916, when most of the preliminary engineering on the present extension was undertaken, the Kingsbury and General Electric thrust bearings had reached a stage of perfection that eliminated the engineering problem in connection with the supporting of the weight of the rotating parts of the unit. These mechanical difficulties having been eliminated, the efficiency of the unit became the deciding factor, and the vertical units were used as offering the best opportunity for the development of a high efficiency. This type also made possible a vertical discharge and eliminated one 90 deg. bend in the draft tube.

Furthermore the surface elevation of the water in the lower river fluctuates through a vertical range of about 30 ft. (9 m.), so that the vertical design of unit offered the only means of getting the waterwheel runner low enough to get the full benefit of the low-water stages and at the same time have the electrical machinery high enough to be safe from damage during high-water stages. The available head obtained by this arrangement varied from 210 ft. to 220 ft. (64 m. to 64.6 m.), the mean being 215 ft. (64.3 m.).

Having determined the head, the maximum safe specific speed for the Francis type of runner was at

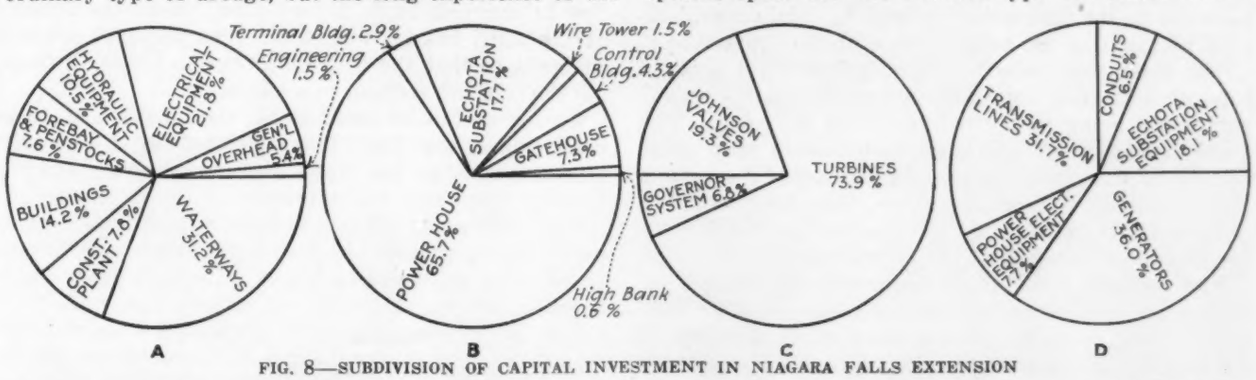


FIG. 8—SUBDIVISION OF CAPITAL INVESTMENT IN NIAGARA FALLS EXTENSION

A and B—Subdivision of expenses for entire extension, including power plant, transmission and substations, classified in two different ways. C.—Subdivision of investment in hydraulic equipment. D—Subdivision of investment in electrical equipment for entire extension. The low engineering expense was due to employing men who were thoroughly familiar with existing conditions and who were thoroughly experienced along lines for which they were responsible. Note that the waterways constituted over 31 per cent of total investment.

once known and gave a rough idea of the limitations of speed and load for each unit. There was available for development 4,400 cubic foot-seconds (123 cu.m. per second), and the problem was to determine the number and size of units which would most efficiently develop that amount of water. Consideration of this feature and the rough limitations set by the specific speed led to the selection of three units as the proper number to use. The number of units being fixed, the next thing was the point of maximum efficiency for each single unit, which was set at the point of use of 1,500 cubic foot-seconds (42 cu.m. per second). The experience of the waterwheel builders was that in order to arrive at this result it would be necessary to design the wheels for a maximum output of from 10 to 12 per cent in excess of the point of maximum efficiency. The builders further agreed that with the hydraulic efficiency naturally to be expected this maximum output would be 37,500 hp. The combination of this maximum output with the specific speed and periodicity of the current to be

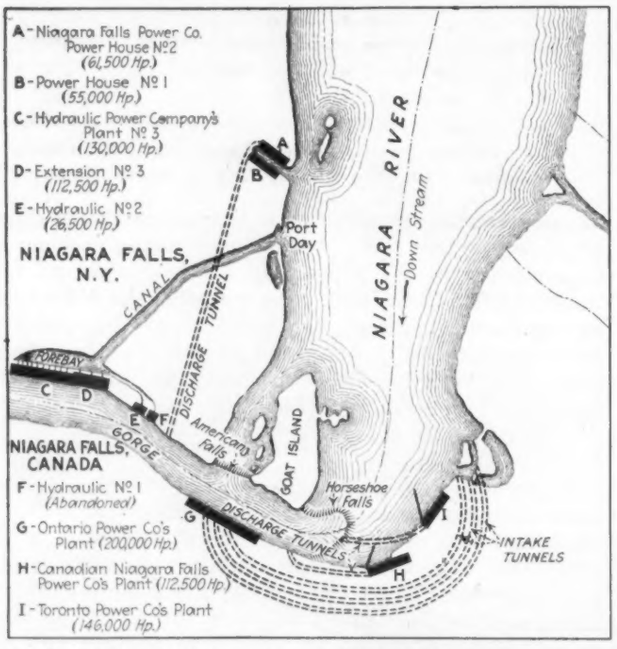

A - Niagara Falls Power Co. Power House No 2 (61,500 Hp.)
B - Power House No 1 (55,000 Hp.)
C - Hydraulic Power Company's Plant No 3 (130,000 Hp.)
D - Extension No 3 (112,500 Hp.)
E - Hydraulic No 2 (26,500 Hp.)
NIAGARA FALLS, N.Y.
CANAL
DISCHARGE TUNNEL
FOREBAY
Port Day
NIAGARA RIVER
Down Stream
GORGE
American Falls
GOAT ISLAND
Horseshoe Falls
NIAGARA FALLS, CANADA
F - Hydraulic No 1 (Abandoned)
G - Ontario Power Co's Plant (200,000 Hp.)
H - Canadian Niagara Falls Power Co's Plant (112,500 Hp.)
I - Toronto Power Co's Plant (146,000 Hp.)
DISCHARGE TUNNELS
INTAKE TUNNELS

FIG. 9—LOCATION OF STATION NO. 3 EXTENSION WITH RESPECT TO OTHER PLANTS IN THE NIAGARA FALLS SYSTEM

generated fixed the speed of the unit at 150 r.p.m. per minute.

Having determined the over-all characteristics of the installation, the first minor problem to obtain consideration was that of the proper shape of the draft tube.

The ideal draft tube would, of course, be a straight tube of uniformly enlarging cross-sections, the expansion angle being in the neighborhood of 4 deg. This ideal shape of draft tube is impracticable in most installations on account of the prohibitive cost of the excavation required. It was necessary, therefore, to determine some form of tube which would accomplish the same purpose in a much shorter vertical distance.

The company's engineers designed and developed an apparatus for testing the regain efficiency of a series of model tubes, and, after a long series of experiments on many different models, decided on the White hydraucone and a somewhat similar form of tube designed by the I. P. Morris department of the William Cramp & Sons Ship & Engine Building Company as offering the best practical solution of the problem.

Hydraulic Design and Efficiency of Units and Plant

Large and Easy Waterways Provided—Two Types of Draft Tubes Selected—New Method of Testing Wheels

BY N. R. GIBSON
Hydraulic Engineer Niagara Falls Power Company

EFFICIENCY was the underlying principle upon which the design of Station No. 3 extension was based, and to this end hydraulic losses were reduced to a minimum by providing large and easy waterways and by special attention to the design of some details which frequently are not so carefully considered. For the nominal velocities in the various waterways, the following were chosen:

	Ft. Per Second
Canal	4.5
Forebay	1.5
Through racks	1.8
Penstock entrances	3.0
Penstocks	8.0
Entrances to turbine gates	17.3
Top of draft tube	20.0
Exist from draft tube	5.0
Tailrace	3.5 to 4.5

With these velocities the resulting hydraulic losses from forebay to tailwater, exclusive of turbine efficiency, has been found to be approximately 2 ft. at normal load, less than 1 per cent total average head available.

In collaboration with the designers of hydraulic turbines, considerable attention was given to the designs of draft tubes, and after experimenting with about twenty-five draft tube models of various designs two types were finally adopted and constructed in the powerhouse foundations. The right hand view of Fig. 7 shows the hydraucone regainer patented by W. M. White of Milwaukee; the left view shows the spreading draft tube patented by Lewis F. Moody of Philadelphia. The efficiencies of these two tubes, as shown by Fig. 4, were practically the same, and both gave results which were far in excess of the efficiency of any other model of equal dimensions.

The effect of these draft tubes is to maintain flow parallel to or radially from a central axis, with a gradual diminution of velocity until the velocity of discharge is finally reached. Such designs allow free play for the whirls in the water as it leaves the runner until the velocity of whirl has been greatly reduced. Large losses are thus prevented which occur when the direction of flow is changed, as in a bent tube, before the velocity of the whirl has been reduced. The passages are also designed so that the hydraulic friction losses throughout the tube are reduced to a minimum.

So far as can be ascertained, the adoption of these draft tubes has been fully justified by the results attained, such as the direct gain in efficiency and the freedom from excessive vibration of the machinery.

The efficiencies of the hydraulic turbines received particular consideration, but no guarantees were exacted from the manufacturers. Instead, each manufacturer agreed that "In lieu of any guarantees of efficiency the contractor will use its best engineering talent and skill in the design and construction of the turbine, to the end that the highest attainable efficiency may be secured. It is expected, but not guaranteed, that the combined efficiency of the turbine and generator will be as high as 90 per cent."

With this ideal constantly in mind each contractor has put into the work the best design, material and workmanship of which he was capable, and more than the expected efficiency has been attained.

Provision for testing the wheels in place was made by building a testing chamber around the base of the slope tunnels so that Pitot tubes or other equipment might be readily installed. While tests of the wheels may be made by using Pitot tubes and chemical gagings, it has not been possible to have such tests carried out up to the present time. However, complete efficiency tests have been made by a new indirect method of water measurement recently invented by the writer. This method, sometimes called the "pressure-time process,"* utilizes the relation between velocity change and rise of pressure, and by means of specially designed apparatus* there is produced a diagram, called the pressure-time diagram, from which the mean velocity in the conduit may be calculated. The apparatus, which is attached to a small piezometer tube tapped into the wall of the penstock at any convenient point, records on a sensitized film or paper the changes of pressure that occur in the penstock with respect to time. The changes of pressure are produced by the simple process of closing the turbine gates, or in some cases the Johnson valve.

The procedure for a test by this method may be briefly described as follows: The turbine gates are put on hand control, and steady conditions of load on the unit are maintained for several minutes until the flow in the penstock has become as uniform as possible. Readings of headwater and tailwater elevations are taken in the usual manner, and the pressure head at the entrance to the turbine casing is observed by gage or piezometer, so that allowance may be made for the loss of head in the penstock. Measurements of the generator output are taken by calibrated wattmeter and auxiliary instruments, and, if the unit is separately excited, ammeter and voltmeter readings of the exciting

*Patents applied for by N. R. Gibson.

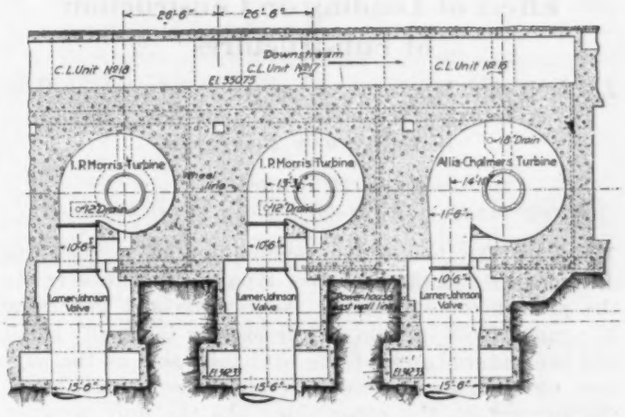


FIG. 11—HORIZONTAL CROSS SECTION THROUGH THE THREE NEW WATERWHEEL FOUNDATIONS

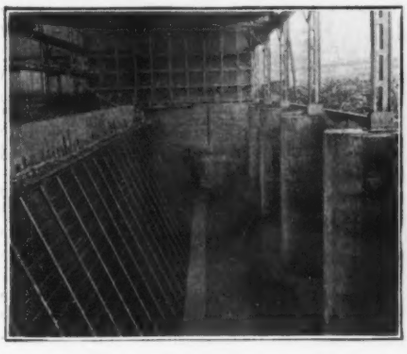
current are also obtained. When conditions have been steady for several minutes the turbine gates are closed gradually by operating the hand-control of the governor. During the closure the load thrown off the generator is taken up by the other units operating in synchronism with it. At the same time the Gibson apparatus makes its record of the changes of pressure that occur in the penstock. From this record may be calculated the mean velocity of the water in the penstock prior to the shutdown. Having determined the velocity, the discharge is readily computed, and after allowing for the known efficiency of the generator the turbine efficiency is calculated in the usual manner.

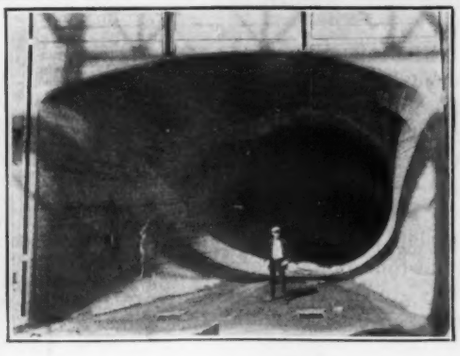
From these tests it has been determined that the turbine efficiencies are in excess of 90 per cent from half gate to full load, reaching in each case a maximum of 93 per cent.

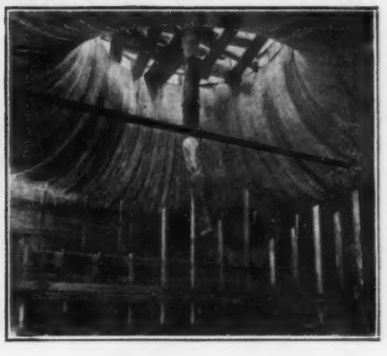
The average combined efficiency curve, including losses in penstock, Johnson valve, turbine and generator, is shown in Fig. 3. It will be noted that at normal load the efficiency from forebay to switchboard is 90 per cent.

FIG. 10 PROVISIONS FOR HANDLING LARGE VOLUMES OF WATER USED BY STATION NO. 3 WHICH, WITH EXTENSION, HAS RATING OF 250,000 HP.

At the top are ice diverters which have been anchored near canal intake to keep the waterway free of ice. Below, at the left, are the intake racks for the new units. The racks are removed when slush ice is flowing. The flaring draft tube of one unit shown in the middle view looms up like a cavern back of the man shown. At the right is a view from the draft tube looking up toward the outlet of one wheel.







Effect of Loading on Construction of Substructures

Large Water Discharge Areas Required Special Construction—Eleven-Foot Foundation Slabs Were Specially Reinforced

BY L. S. BERNSTEIN
Designing Engineer Niagara Falls Power Company

IN PLANTS where the combination of a moderate discharge and the bent-tube type of draft tube exists the problem of supporting the turbine and generator is comparatively simple, as the loading is usually small and the natural arch of the bent tube acts as the support on one side and the concrete mass foundation as the support on the other side. As the unit becomes larger and both the clear span of the tailrace and the load to be supported become greater, however, the arch type of construction is not feasible, so the problem of supporting the unit becomes more complicated.

Where the turbines and generators are of extreme size and weight, as was the case at Niagara Falls, special provision must be made to take care of the vibration of the machine as well as the superimposed loads.

In the Niagara Falls development two types of waterwheels and draft tubes were used, so the substructures differed in some details. The draft tube of the Allis-Chalmers unit consists of a horizontal reinforced-concrete plate supported by three reinforced-concrete walls, the entire structure being centered in the tailrace directly under the discharge of the turbine. The draft tube of the I. P. Morris unit consists of heavy flared reinforced-concrete wings suspended from the foundation slab of the unit and a center cone extending up between and centering these wings. The foundations for the units outside of the draft tube are practically the same.

CONDITION OF LOADING

In the Allis-Chalmers unit the generator is supported by a heavy cast-iron frame called the "pit liner," which in turn is carried by the speed ring. The latter is supported by another circular casting called the "discharge ring," which rests on the foundation slab. The concrete inside of this casting is cut out and formed to the shape of the draft tube.

The generator in the I. P. Morris unit is supported by massive concrete piers which rest directly on the heavy cast-iron wheel case. The load is transferred from the wheel case to the foundation slab and the distribution is more favorable than in the other unit. The flared wings of the draft tube are attached to the bottom of the main foundation slab with three rings or reinforcing bars. The opening in the main slab is similar to that of the Allis-Chalmers unit.

The main foundation slab is 11 ft. (3.3 m.) thick and has a clear span of 45 ft. (13.5 m.). The reinforcing consists of eight bands of steel bars, each band containing twenty-five 1½-in. (3.75-cm.) square bars. In addition to this there are about 450 vertical 1-in. square bars, spaced on about 2 ft. (0.6-m.) centers over the entire area, acting like stirrups. For construction reasons it was decided to pour this slab in two layers. In addition to these vertical bars, limestone plums were placed so that about one-half of the stones projected above the neat line of the first pour to serve as an additional horizontal tie. The entire surface was picked, roughened and thoroughly cleaned before the final pour was made.

In the design of the main foundation slab each band was considered acting as a beam and assumed to carry one-eighth of the total load inside the neat line of the foundation piers, the load being considered as uniformly distributed. The foundation slab is carried by the main power house piers, which are spaced on 53-ft. (15.9-m.) centers, and one smaller center pier. The main piers taper from the river face of the power house to the center line of the unit and are joined together next to the bedrock by concrete to give a horseshoe-shaped tailrace.

[In later issues will appear contributions on the waterwheels, generators, electrical layout of the generating station, transmission line and substation.—EDITOR.]

Regulations Governing Water Power Permits and Licenses

REGULATIONS governing the application for and the granting of water power permits and licenses under the recently passed water power bill have been completed by the Federal Power Commission. There are ten regulations, as follows: (1) Definition of terms, (2) applications—general requirements, (3) applications for preliminary permits, (4) applications for licenses—major projects, (5) applications for licenses—minor projects, (6) applications for licenses—major projects already constructed, (7) declaration of intention, (8) priorities and preferences, (9) permits, (10) licenses. The last three are considered to be of such general interest that they are here printed in full.

REGULATION 8. PRIORITIES AND PREFERENCES

A. Priority of application for a license may be initiated either by the filing of such application under the provisions of Regulations 2 and 4 or 2 and 5, or by the filing of an application for preliminary permit under the provisions of Regulations 2 and 5, and will be established either by the issuance of a preliminary permit, or, if no preliminary permit has been issued or applied for, by the approval of the application for license. When two or more applications are filed for the same site the commission will give full consideration to all pertinent matters, including the relative dates of filing of application, before taking final action upon such applications.

B. Priority established by preliminary permit may be lost if there is failure to fulfill the requirements of the permit; if the permit is canceled by order of the commission upon failure of the permittee to comply with the conditions thereof; or if in the course of consideration by the commission of an application by the permittee for license, such permittee shall not before the expiration of the term of the preliminary permit or such later date as may be fixed by the commission,

(a) File data required by the commission in addition to that contained in, or furnished with, the application, or,

(b) Present satisfactory evidence of ability to carry out the plan set forth in the application, or,

(c) Accept the conditions of a proposed license, or,

(d) Modify its plans as required by the commission, if the project adopted by the applicant as disclosed in the plan set forth in the application is not such as in the judgment of the commission will be best adapted to a comprehensive scheme of improvement and utilization for the purposes of navigation, or water power development, and of other beneficial public uses.

C. Priority established by approval of application for license may be lost if the conditions of the proposed license are not accepted within a time fixed by the commission.

D. In issuing preliminary permits, or licenses where no preliminary permits have been issued, and in issuing licenses

to new licensees under section 15 of the act, the commission will give preference to applications therefor by states and municipalities, provided the plans of the same are deemed by the commission equally well adapted, or shall within a reasonable time to be fixed by the commission be made equally well adapted, to conserve and utilize in the public interest the navigation and water resources of the region; and as between other applicants, the commission may give preference to the applicant the plans of which it finds and determines are best adapted to develop, conserve, and utilize in the public interest the navigation and water resources of the region, if it be satisfied as to the ability of the applicant to carry out such plans; but such preferences will not be deemed to apply to the issuance of license under the provisions of the first paragraph of section 23 of the act.

REGULATION 9. PERMITS

A. Except as hereinafter provided, preliminary permits may be issued on the application of citizens, associations, corporations, states or municipalities desirous of obtaining licenses for the construction, maintenance or operation of dams, water conduits, reservoirs, power houses, transmission lines, or other project works necessary or convenient for the development and improvement of navigation, and for the development, transmission and utilization of power across, along, from or in any of the navigable waters of the United States, or upon any part of the public lands and reservations of the United States (including the territories), or for the purpose of utilizing the surplus water or water power from any government dam.

B. Permits will be issued only for the purpose of enabling applicants to maintain their priorities while securing the data required for an application for license and will be for such periods, not exceeding a total of three years, as in the judgment of the commission will be necessary for studying the proper location and design of the project; for making examinations, surveys, maps, plans, specifications and estimates; for conducting stream measurements; for sinking test pits or making borings to determine foundations for dams or other structures; for securing a market for the power to be developed; for making financial arrangements; or for any other purpose necessary or desirable in the preparation of application for license.

C. Permits will not be issued for projects already constructed; for transmission lines alone; for projects of a power capacity of less than 100 horsepower; for projects which, in the judgment of the commission, do not come within the scope of its authority under the act, or should be undertaken by the United States itself, or do not propose adequate scheme of development, or would unreasonably interfere with projects under permit, license or other authority theretofore granted; or for projects for which data sufficient for filing application for license are already available. Permits affecting any reservation will be issued only after a finding by the commission that the proposed use will not interfere or be inconsistent with the purpose for which such reservation was created or acquired. Permits will not be issued until after the expiration of the publication period prescribed by the act.

D. In acting upon applications for preliminary permits, and in determining preferences therefor, the commission may in its discretion, upon the request of any applicant or upon its own motion, hold hearings, order testimony to be taken by deposition, summon witnesses, or require the production of documentary evidence.

E. No charges will be made for permits, but permittees will be required, as a condition of maintenance of priority, to perform such work and to make such studies and investigations, and such reports thereon, as in the judgment of the commission may be necessary or desirable to enable both the applicant and the commission to determine the feasibility, and the character and extent of development, which is proposed or which should be undertaken, which requirements will be expressed in the permit.

F. Upon a satisfactory showing of reasons therefor the commission may authorize permittees to perform such construction work as may be necessary to maintain water rights under state law, or as may be desirable in preparation for the construction of project works; but the granting of such authority shall not be deemed to have created any equities or to have established any rights beyond what would have been created or established had such authority not been given.

G. Permits will not be transferable and may be canceled by order of the commission for failure to comply with the conditions thereof.

H. Each preliminary permit shall set forth the conditions under which priority shall be maintained and a license issued, and shall also set forth the essential terms and conditions of such license.

REGULATION 10. LICENSES

A. Except as hereinafter provided, licenses may be issued either in accordance with the provisions of preliminary permits or upon direct application therefor by citizens, associations, corporations, states or municipalities, for the purpose of constructing, operating, and maintaining dams, water conduits, reservoirs, power houses, transmission lines, or other project works necessary or convenient for the development and improvement of navigation, and for the development, transmission, and utilization of power across, along, from or in any of the navigable waters of the United States, or upon any part of the public lands and reservations of the United States (including the territories), or for the purpose of utilizing the surplus water or water power from any government dam.

B. Licenses will be issued for such periods, not exceeding fifty (50) years, as in the judgment of the commission will, in each individual case, allow for the satisfactory development and operation of the project and protect the public interest, and shall remain in full force and effect for such periods unless surrendered or terminated as provided in these regulations or revoked as provided in the act.

C. Licenses will not be issued for projects which, in the judgment of the commission, do not come within the scope of its authority under the act, or should be undertaken by the United States itself, or do not propose adequate schemes of development, or lack satisfactory showing of financial ability, or would unreasonably interfere with projects under permit, license, or other authority theretofore granted, or would be opposed to the public interest. No license affecting the navigable capacity of any navigable waters of the United States will be issued until the plans of the dam or other structures affecting navigation have been approved by the Chief of Engineers and the Secretary of War. Licenses within any reservation will be issued only after a finding by the commission that the license will not interfere or be inconsistent with the purposes for which such reservation was created or acquired. Licenses will not be issued until after the expiration of the publication period prescribed by the act.

D. Licenses may be altered only upon mutual agreement between the licensee and the commission. Any such alteration shall be made a part of the license and a substitute for the provision altered, but no such alteration shall operate to alter or amend or in any way whatsoever be a waiver of any other part, condition, or provision of the license.

E. Licenses may be surrendered only upon mutual agreement between the licensee and the commission, and upon the fulfillment by the licensee of all obligations under the license, with respect to payment or otherwise, existing at the time of such agreement, and, if the project works authorized under the license are constructed in whole or in part, upon such conditions with respect to the disposition of such works as may be determined by the commission.

F. Licenses may be terminated by written order of the commission after such reasonable notice, not exceeding ninety (90) days, as the commission may grant, if there is failure to commence actual construction of the project works within the time prescribed in the license, or as extended by the commission. Under similar conditions and upon like notice the authority granted under a license may be terminated with respect to any project works or separable part thereof covered by the license, if there is failure to begin construction of such project works or parts thereof within the time prescribed in the license or as extended by the commission; but no part of the project works shall be deemed separable for the purposes of this regulation unless so specified in the license.

G. Licenses may be revoked only through proceedings in equity instituted in a district court of the United States for a district in which some part of the project is situated, and in the manner provided in the act,

(a) In case construction of the project works covered by the license, or of any specified part thereof, has been begun but not completed within the time prescribed in the license, or as extended by the commission; or

(b) In case the terms of the license are violated by the licensee.

One Hundred Years Ago Today

Ampère Stated the Fundamental Electromagnetic Laws on Sept. 18, 1820, Based Upon the Discovery by Oersted That a Magnetic Field Is Set Up About a Conductor Carrying a Current

THERE are probably no more interesting pages in history than those into which are written the achievements of the early experimenters in electrical science. The present generation has seen a remarkable engineering development; the rise of radio communication, electric lighting and transportation and even the telephone have been witnessed by many who read these pages. No less remarkable, however, were the accomplishments of those who laid the foundation for electrical engineering a century ago, and it is particularly fitting, in this issue of ELECTRICAL WORLD, to call attention to the events leading up to the announcement by Ampère, on Sept. 18, 1820, of the laws governing the effect of a wire carrying a current upon a magnet and also on Sept. 25 of the same year, the force action of one wire carrying a current upon another. The paper by Ampère was frankly based upon the earlier work of Oersted, who discovered the effect of an electric current upon a compass needle and who explained the concentric nature of the magnetic field set up about a conductor carrying an electric current.

HANS CHRISTIAN OERSTED (1777-1851)

ANDRE MARIE AMPERE (1775-1836)

Volta in Italy had already produced the voltaic pile, made of layers of copper and zinc separated by a wet cloth, in 1799, when Hans Christian Oersted, a professor of natural philosophy in the University of Copenhagen, took up his study of electricity. It is said that he first noticed the effect of an electric current upon a compass needle when he brought a compass near a voltaic pile from which current was flowing, thus accidentally making a great discovery. There is evidence, however, that he had some conception of a relationship between electricity and magnetism as early as 1813, although he did not actually establish this relationship until 1820. But on July 21 of that year his famous paper "Experiments on the Effect of a Current of Electricity on the Magnetic Needle" was published and from that beginning progress in electrical science was rapid.

It is interesting to recall the words of Oersted, who gave his conclusions regarding the magnetic field set up about an electric current as follows: "It is sufficiently evident that the electric conflict is not confined to the conductor, but is dispersed pretty widely in the circumjacent space. We may likewise conclude that this conflict performs circles round the wire, for without this condition it seems impossible that one part of the wire when placed below the nagnetic needle should drive its pole to the east, and when placed above it should drive its pole to the west." This statement also offers a viewpoint from which one may appreciate the fact that Oersted and others of his time worked upon phenomena which could not yet be defined, for which there was yet no language with which to express the facts, and with only the voltaic pile and the compass for laboratory equipment.

Several weeks after the announcement by Oersted, his experiments were repeated before the Academy of Sciences at Paris on Sept. 11 and witnessed by the eminent French professor André Marie Ampère. Ampère's ability as a philosopher and scientist may be appreciated when it is recalled that his famous paper appeared on Sept. 18, a week later, in which he gave a complete explanation of the phenomena observed by Oersted. Ampère's analysis still remains a classic in electrical literature. Not only did Ampère show the force action between a magnet and an electric wire but he quickly analyzed that between two currents, and he also followed this up by showing that coils of wire carrying current developed magnetic poles and which were subject to calculation based upon his paper of Sept. 18.

With the establishment of the facts concerning electromagnetism and electrodynamics by Oersted and Ampère electrical developments followed in rapid succession. Ohm, in Germany, established the relation between electrical pressure, current and resistance which made possible a better understanding of the electric current and its control. A powerful electromagnet was also devised by William Sturgeon in 1825 by winding a spiral conductor upon a horseshoe magnet of soft iron.

In this period of important electrical development America was ably represented by Joseph Henry, who shares with Faraday the honor of discovering that induced currents are set up in a conductor by varying the magnetic field with which the conductor is linked. Henry also was first to conceive the notion of inductance or electrical inertia, and the unit inductance was quite appropriately given his name. The Yankee genius of making practical use of the progress in science was also demonstrated in the setting up and working of the first electromagnetic telegraph by Henry in 1831.

With this foreword to give some idea of the period in which Oersted and Ampère worked, a series of letters from prominent men in electrical science of this day has been arranged to express the debt of our own generation to these brilliant scientists of a century ago.

Ampère Gave Generous Credit to Oersted

A LETTER on this subject by the writer was published in the ELECTRICAL WORLD of June 19, 1920, also an editorial commenting on the same. That letter gives briefly the facts in the case as to the discovery of electromagnetism by Oersted and the complete working out of its theory, also the phenomenon and theory of electrodynamics, by Ampère. Particular attention was called to the fact that Ampère was able in one week to work out and formulate the theory of these two branches of science, also performing considerable experimental work on which his theory was based.

A book in the possession of the writer has the name "A. M. Ampère"

Francis B. Crocker

in his own writing on the title page. This book is particularly valuable in giving a detailed—in fact, almost daily—account in diary form of Ampère's work, both experimental and analytical. The book was written by Ampère himself and it is very significant, also characteristic, of his generous nature that the name "Oersted" usually appears several times on every page. Indeed, more than full credit is given to Oersted by Ampère for the discovery of the phenomenon.

Of course, the discovery was a very great event in the history of science and Oersted is entitled to much credit for making the discovery. Nevertheless, it was Ampère who carried the experimental work much farther in a more definite and quantitative manner and to him the principles and theories are almost entirely due. Moreover, the discovery, based on his own experimental facts, as well as the theory of electrodynamics, is all entirely due to Ampère.

It is all the more striking and all the more admirable in Ampère that he gave Oersted such full credit. The former was in Paris and presented papers to the Academy of Sciences nearly every week. He was in close touch with and in many cases actually had the ear of many of the most prominent scientists of Europe. Oersted was in Copenhagen, in those days far away from Paris. It would have been very easy for Ampère to have more or less ignored or gradually eliminated Oersted. In all of his published statements, however, for many months, if not years, he never failed to be more than magnanimous.

FRANCIS B. CROCKER,
Crocker Wheeler Company
Ampere, N. J.

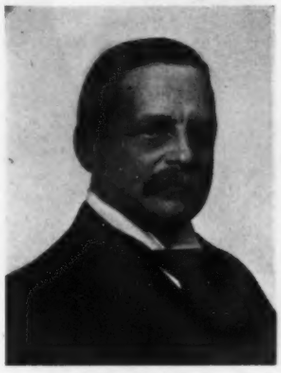
Electromagnetism One Hundred Years Old

WHILE even in the days of Franklin's investigation of the electricity of friction—later called static electricity—there was present a suggestion of some relation existing between electricity and magnetism, it was not until two-thirds of a century later that this relation was established by Oersted's simple experiment of the deflection of a compass needle by a wire conveying a battery current.

It is on record, however, that Romagnosi of Trent about 1802 observed in a rather indefinite way that a voltaic pile affected a compass needle. It is probable that the current flowing was too small and too variable in his case to give results so definite as to command investigation, and it must be remembered that even in Davy's experiments in the early years of the last century the internal resistance of the batteries used was so high that in spite of the coupling of thousands of cells in series the current in a wire in the circuit must have been small. The coiling of the wire to increase its effects came much later. Oersted of Copenhagen made the real discovery. He found that a magnetic needle tends to set itself at right angles to a wire carrying a voltaic-battery current and investigated the law of turning to right or left according to the direction of the current in the wire and the position of the wire itself in relation to the free needle. The announcement of this great but simple discovery was received with much enthusiasm among the scientific men of the time, and experiment and discovery followed one another rapidly in the hands of Davy, Ampère, Arago and others.

Schweigger's so-called multiplier was the forerunner of galvanometer coils of many turns surrounding a poised magnetic needle and incidentally laid the foundation for the needle telegraph developed by Wheatstone. Sturgeon's early electric magnet, with its iron coil of horseshoe form surrounding a layer of wire, was perfected by Henry, who showed the need of many turns in layers to produce strong electromagnets. One may readily trace the advances through the years following 1820 and include Faraday's discovery in 1831 of the generation of current in magnetic fields—a discovery no less fundamental than that of Oersted.

The present year marks without doubt the centenary of electromagnetism, the development of which gave us in succession a wonderful series of splendid discoveries and the application of whose laws gave



Elihu Thomson

rise, to the telegraph on land and sea. The telephone came later, along with the dynamo and the electric motor, as applied to driving machinery, to locomotion and to the multitude of affairs now so important in our lives.

The coiled wire, the iron coil—what wonders they have brought about!

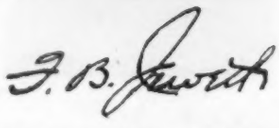
ELIHU THOMSON,
Consulting Engineer, General Electric Company, Swampscott, Mass.

Hundred Years in Electrical Research

THE fact that a hundred years comprises the entire span of electrical science as it exists today is a matter difficult of appreciation, even by those of us who pride ourselves on a reasonable familiarity with the history of our art. To be sure we are familiar with Faraday, Joseph Henry, Maxwell, Helmholtz, Heaviside and Kelvin and what they did in the way of building a solid foundation for our present superstructure. How many of us, however, appreciate that the real birth of modern electrical science took place a hundred years ago today, when Am-

père presented his historic paper based on the work which he did and Arago had done following the then recent discovery of Oersted, that electricity and magnetism were definitely related one to the other?

No single year in the entire history of electrical development has been more pregnant with discoveries of a revolutionary character than was the year 1820. Prior to that time all that the world knew of the present science were a few discreet and unrelated fragments of knowledge concerning voltaic electricity and the magnetism of lodestones. While many had dreamed and specu-



lated on a possible relation among these fragments, it remained for Oersted, university professor of Copenhagen, to discover the true relationship and unlock the gates to the flood of discovery and invention which has tended so much to the happiness and good of mankind.

While we consider and marvel at the debt which the present day world owes to these workers of a hundred years ago, there is one fact in connection with their work which we should not lose sight of. It is a fact which had then and still has an intense and vital bearing on the progress of science. At the time of these epoch-making discoveries, and for nearly three-quarters of a century afterward, the term "industrial research" was unknown. The discoveries which these men made were in the course of a search for the abstract truths of nature.

In our present-day quest to build up the efficient industrial research laboratory we must still look to the university laboratories for our supply of trained investigators and, in large part, for those far reaching scientific discoveries which will later prove so revolutionary in the conduct of human affairs.

F. B. JEWETT,
Ryerson Physical Laboratory,
University of Chicago.

Growth from First Discoveries Like Huge Tree

WHEN one begins to make a careful study of the tree of modern industrial civilization, following back any particular leaf or flower through twig, stem, branch, and trunk to top root, he can scarcely fail, no matter with what particular modern development he starts, to trace the line of causes back through either Faraday, Oersted and Ampère to Volta, or else through Joule, Carnot and Rumford to Watt. For surely *the top root of modern civilization is to be found in the principle of energy* and its thermal and electrical application. The latter all go back to Oersted and to Ampère, for are they not the scientific ancestors of Faraday?

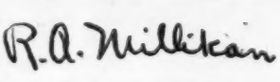
I have below taken at random four fields of very recent development, two of them, the second and fourth, of immense scientific and philosophic interest; the other two, the first and third, of great practical importance, the one in a physical, the other in a biological sense, and have merely sketched in this manner their scientific genealogy, not including all the names which might properly find a place, but merely inserting a series of appropriate "key names."

1. *Electronic Amplification.* De Forest, Richardson, Thomson, Roentgen, Lenard, Hertz, Maxwell, Faraday, Ampère, Oersted.

2. *Relativity.* Einstein, Lorenz, Becquerel, Roentgen, Lenard, Hertz, Maxwell, Faraday, Ampère, Oersted.

3. *Radio Therapy.* Rutherford, Crivic, Roentgen, Lenard, Hertz, Maxwell, Faraday, Ampère, Oersted.

4. *Subatomic Structure.* Sommerfeld, Bohr, Rutherford, Thomson,



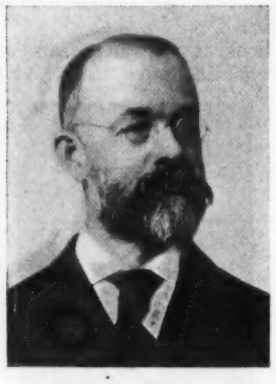
Roentgen, Lenard, Hertz, Maxwell, Faraday, Ampère, Oersted.

These are merely illustrative of what might be done presumably in scores of other fields. They illustrate also the immeasurable value to mankind of the work of the pure scientist and the imperative necessity of stimulating and supporting him. With one single exception all of the foregoing names belong to men who devoted their whole lives to pure science.

R. A. MILLIKAN,
Ryerson Physical Laboratory,
University of Chicago.

Laws of Oersted and Ampère Still Stand

IT IS FITTING to couple together the names of Oersted and Ampère in commemorating the centennial of the discovery of the magnetic relations of the electric cur-



rent. Taken together, their investigations laid the foundations of modern electrical engineering and the great subsequent advances by Faraday and Henry followed almost as an inevitable consequence.

Oersted's discovery of the movement of a compass needle when brought near an electric circuit is often classed as an accident, wrongly, I think, for, although the fact was quite different from what had been expected, Oersted had long sought a relation between electricity and magnetism. His experiment, beautifully and clearly described in his paper of July 21, 1820, was an essential forerunner to the work of Ampère; for there is no reason to think that any one in France had been considering possible electromagnetic relations up to the time when the news reached Paris.

Arago brought it with him on Sept. 11 from Geneva, where he had witnessed de la Rive's repetition of Oersted's experiment, and that same evening he showed the effect at the Institut de France.

Ampère was doubtless present at that meeting and *just one week later*, on Sept. 18, he gave before the Academy of Sciences his complete demonstration of the laws of the in-

teraction between electric circuits. The work was so well done, in spite of the extraordinary speed of production, that it has needed no restating or modification from that day to this.

I know of no achievement to match this of Ampère unless it be that of Fresnel, who wrote to a friend: "I do not know what is meant by the polarization of light" —and who a few weeks later had completed his epoch-making first memoir on that subject. Incidentally he furnished the final and decisive proof of the wave theory of light.

Ampère's reaction to the stimulus of a new idea was, however, even more rapid and amazing, and his discovery has obviously had a much more direct influence upon the development of applied electricity.

EDWARD L. NICHOLS,
Professor Emeritus,
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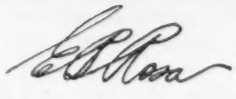
Many Devices Are Repetitions of Early Work

FOR MANY YEARS attempts had been made, without success, to find a connection between magnetism and electricity. One of the most diligent searchers after



this relation was Oersted, professor of natural philosophy and secretary of the Royal Society of Copenhagen, at Copenhagen. In 1820 he discovered that if a wire be placed parallel to a magnetic needle and an electric current be passed through it, the needle is deflected and tends to place itself perpendicularly to the current. Conversely, he showed that if the magnet be fixed and the current movable, the latter is deflected.

Oersted's discovery was reported to the French Academy on Sept. 11, 1820. One week later, at a meeting of the same body on Sept. 18, Ampère presented a paper confirming these results and pointing out the possibility of long distance signaling by such means. At a subsequent meeting on Sept. 25, he showed that parallel currents in the same direction attract each other, and in the opposite direction repel, and that a wire carrying a current attracts iron filings to itself as a magnet would do.

During the next few years he continued his investigations, devising ingenious and beautiful experiments to demonstrate the quantitative laws of electrodynamics.

Maxwell speaks of the experimental investigation by which Ampère established the laws of the mechanical action between electric currents as one of the most brilliant achievements of science. "The whole, theory and experiment, seems as if it had leaped, full grown and full armed, from the brain of the Newton of electricity. It is perfect in form and unassailable in accuracy, and it is summed up in a formula from which all the phenomena may be deduced, and which must always remain the cardinal formula of electrodynamics."

It is remarkable that at so early a date and so soon after Oersted's discovery of the action of a current upon a magnet Ampère should have worked out so completely and so perfectly the theory of such action.

The practical applications of these discoveries have been many, and they have been of tremendous importance. In electrical instruments, in electrical communications, and in deriving mechanical from electrical energy, the action of a magnetic field upon a magnetic needle or upon an electric current have been essentially a repetition of those pioneer experiments of 1820; and we do well to pause a moment at the centennial of these epoch-making achievements to recall and to honor the names of Oersted and Ampère.

E. B. ROSA,
Chief Physicist, Bureau of Standards,
Washington, D. C.

Oersted and Ampère Built a Solid Foundation

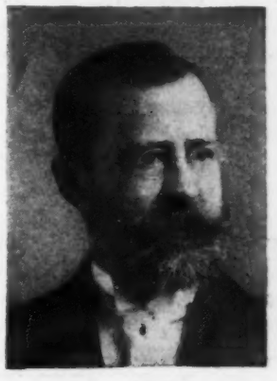
IN BUILDING a great structure it is of the first and utmost importance to have an absolutely reliable foundation for it to rest upon, especially when the ultimate weight of the structure is unknown and may grow much greater than was originally expected; it should therefore be built on solid rock. It is in the laying of this solid and reliable foundation on which the theory and application of electricity was built that Oersted and Ampère contributed such a valuable part by the discovery of some of nature's laws; and their work was all the more creditable because in those early days there existed not only very little knowledge on the subject, but worse than that, the competing hypotheses were even inclined to lead one off the track.

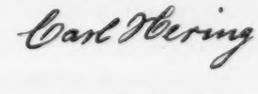
We, who now benefit so greatly in the building of a superstructure on this foundation, and to whom the results of the work of these pioneers is now the A, B, C of our science, often forget or fail to appreciate the great difficulties they labored under, and the lack of prior knowledge available to them at that time.

Sometimes a foundation can later be extended or improved, but this does not detract from the pioneering work; Ampère, for instance, studied the mechanical forces of currents upon each other, but not the internal forces upon its own conductor, to crush or stretch it, as in the pinch effect.

Sometimes even the best of foundations will sag a little here and there in the course of time and require a little repairing, which then makes them better than they were before. But slight flaws found later are to be expected and do not reflect on the original workers.

Sometimes a violent earthquake shatters even the supposedly solid rock foundation on which a magnifi-



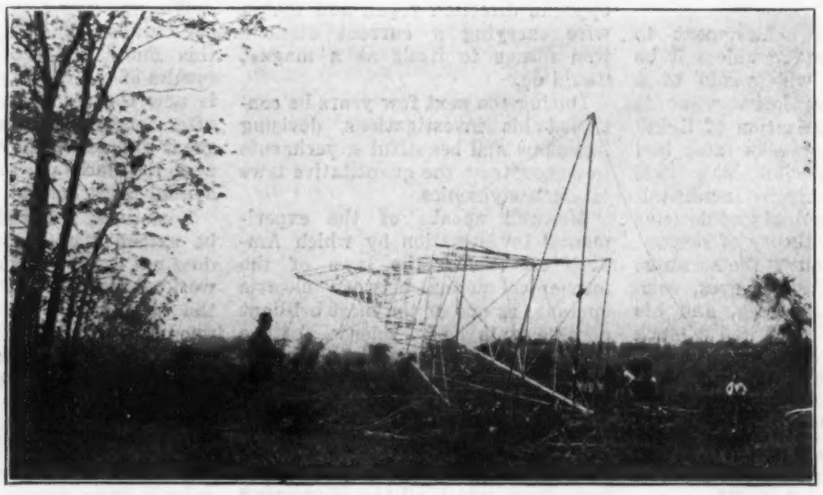


cent superstructure had been resting securely for many years, and compels us to start rebuilding on a new and still firmer foundation; such an earthquake is illustrated in the recent revelations of Einstein; but for many years the former superstructure had served a useful purpose, as it was not built on sand. And if, as seems to be boldly predicted by the disciples of Einstein, even the science of mechanics is to rest on electrodynamics as a subfoundation, the researches of Oersted and Ampère will be even more fundamental than they themselves had supposed.

CARL HERING,
Consulting Electrical Engineer,
Philadelphia, Pa.

Utility Construction Accounting

This Vital Factor Should Be a Part of General Accounting Records—Systems Must Be Devised to Fit Viewpoints of Construction and Accounting Departments—Property Addition and Depreciation Factors Demand Consideration



On as big a job as constructing a generating station a cost accounting system is almost certain to be used, but on smaller undertakings, like building transmission and distribution lines, the accounting is often neglected. Still, because of the greater recurrence of such jobs, proper accounting is most important.

CONSTRUCTION accounting has not as yet received the broad meaning that it should and must have if the best interests of public utility accounting are to be served. It has ordinarily been treated in its relation to the job without adequate consideration of its relation to the general accounting system, company history and the dealings that the company must have with regulatory bodies in the establishment of service rates.

Broadly construction accounting may be treated as follows:

1. As a historical cost record of a specific job.
2. Its record of a specific job as an integral part of the general property accounts to be maintained so long as the property it deals with remains in existence.
3. An ideal situation would be one in which the physical property accounts of a corporation were backed by construction records whose accuracy was unquestioned. The original cost value of the property could therefore not be successfully attacked.

Historical Record

The importance of the historical cost record of a specific job is usually called into question on the ground that few if any utility construction jobs are ever actually duplicated and it is impossible to judge fairly as to the cost of succeeding jobs by the records of those preceding. The fallacy of such an argument lies in the assumption that there is no relation between the fundamental operations in jobs of the same general type because they bear no surface similarity. The fundamental operations in the construction of a line, power plant or substation are the same as those for any other job of the same type. A construction cost record that reveals abnormal costs and forces an explanation has a decided influence in causing avoidance of the same type of errors in future work. Such a record also tells construction men the normal costs and sets them to devising more economical ways of doing work, exercising a decided influence in eliminating carelessness in planning and supervising the work of construction forces.

In the second phase the most valuable feature of proper construction accounting appears. It, however, is the one most often entirely ignored. It is not an unusual thing to find the cost of specific jobs so distributed in a general accounting record that the assembly of the total costs is an impossibility, and even when they can be assembled they are found so full of errors due to improper distribution on original vouchers that the figures are valueless. The general property accounts are a vital part of the record upon which the business is founded, and a condition of this sort means that in a controversy the business may be attacked at a vital point, viz., whether the investment shown in the general property accounts is actually there, a very pertinent question in any controversy, as on its answer may depend the determination of the good faith and business ability of the company.

To meet the ideal situation the first and most important step is the establishment of a construction accounting system that will cover all the factors that must enter into the final general property accounts. These factors may be defined as follows:

New Construction.—Comprising the cost of all construction that has not previously been in existence.

Replacements.—These are ordinarily understood to represent replacements in kind, though, practically, such a thing seldom or never occurs. To simplify, this term is therefore combined with betterments.

Betterments.—This term represents the replacement of a property unit by a unit that increases the general property value.

Depreciation.—Representing the property units that are removed during the installation of units that constitute betterments. Some criticism may be offered

of the use of this term in this manner, but for the simplification of the discussion it will be understood as including not only physical depreciation due to natural wear and tear but depreciation of property due to the growth of service demands and development of the art.

In building up a construction accounting system two factors representing working conditions to be contended with must be considered, the first being that the accountant ordinarily has no conception of the practical working out of an accounting system on a construction job, and the second being that the best construction men have an equally small knowledge of the accountant's habits of thought and methods of work. Any attempt to talk debits and credits, betterments or depreciation in technical terms to the average construction man is as hopeless as an attempt to talk of engineering problems in technical terms to a first-class accountant. The problem therefore resolves itself into one of reducing the system to terms that both can translate readily into their own terms. This cannot be done by making the general accounting classification the basis of the construction classification. General property classifications are naturally so broad in scope that even the most competent of accountants will differ as to the items that belong in any given group. The field construction accountant cannot be expected intelligently and consistently to interpret and apply such a classification to his work. To maintain a consistent record the interpretation and application of the general accounting classification should be confined to one source, which should be a construction accounting department, the primary responsibility of which includes not only construction accounting but the proper interpretation of the relation between contruction and general property accounts. Such a department is the point of contact between the general accounting department and the construction forces and must learn to think in the terms of both. For successful results the only form of classification that can be applied to construction work for field use is one based solely on labor and material items. These the construction man understands, and with a classification properly constructed training will reduce the errors to a mimimum.

Distinguishing Between Accounts

To maintain the proper distribution between new construction, betterments and depreciation two forms of designation, one of which must be used with every charge against the construction classification, are suggested. These are new construction, abreviated "Ncn," and reconstruction, abbreviated "Rcn." The designation "Ncn" is used to cover all new material and labor installation charges regardless of whether they cover an absolutely new property unit or replace an old one. "Rcn" designates all charges for labor, handling and hauling, etc., incurred in (a) moving and reinstalling old equipment, (b) removing old equipment from service and placing it in storage, (c) any new construction material that may be necessary for temporary use in handling or removing old equipment.

With the foregoing designations properly used the charges against a job readily segregate into two groups, one of which is the cost of all new equipment installed and the other the cost of wrecking and removing or changing location of existing equipment. The general accounting department will be able to dispose of these charges between property and depreciation maintenance or operating accounts without difficulty, but will find itself without an adjustment in property accounts that may be made necessary by the removal of operating property from service. The adjustment is easily made by writing off either the actual original cost of the apparatus if available or the estimated original cost. While this operation should be connected with the construction accounting for the job it should be done through the construction accounting department and without any knowledge on the part of the field accounting force, except that it is responsible for reporting a physical inventory of the material removed from service. Beyond this its knowledge of operations should cease.

Principal Accounting Operations

As a summary in brief of the various main operations involved in construction accounting the following are illustrative, it being assumed that an individual accounting record of the job with an adequate classification is kept and transferred to property accounts when the work is complete.

NEW CONSTRUCTION (Ncn)

DEBIT	CREDIT
Charge with the cost of all new material, labor of erection, handling and hauling and all other costs of new installations.	Credit with all new unused materials returned to stock from the job. Close by transferring the balance to general property accounts.

The debit balance transferred to property accounts represents (a) the total cost of the job where only new work is involved and (b) the portion of the cost representing property additions where the work represents betterments. The figures in either case represent increased property values created by the work.

RECONSTRUCTION (Rcn)

DEBIT	CREDIT
Charge with the cost of labor and new material (for temporary use only) required in the wrecking and removal of old equipment, and also the cost of tearing down and re-erecting old equipment on the same job.	Credit with the salvage value of all material charged to Rcn. for temporary use in removing old equipment. Close by transferring the balance to depreciation or maintenance accounts.

The debit balance represents the costs of handling, removing and re-erecting old material that do not increase property values. The only material legitimately chargeable to Rcn. is temporary construction material required in the wrecking process.

PROPERTY ACCOUNTS

DEBIT	CREDIT
Charge with the debit balance credited to New Construction.	Credit with the original or estimated original installed value of all old equipment removed from service.

The difference between the debits and credits here represents the net increase or decrease of property values.

STORES ACCOUNTS

DEBIT	CREDIT
Charge with the salvage value of all equipment removed from active service. Charge with all material originally charged to "Ncn" or "Rcn" and returned unused or salvaged.	Credit with the value of all material charged to "Ncn" and "Rcn" for use on the job.

DEPRECIATION OR MAINTENANCE ACCOUNTS

DEBIT	CREDIT
Charge with the debit balance from "Rcn" and the difference between credits to "Property" and the salvage value of equipment charged against stores.	

The above grouping represents the main operations that any construction accounting system must be concerned with. Of these groups "Ncn" and "Rcn" are the only ones the field accountants need be concerned with, the remainder coming solely under the province of the office end of the construction accounting department.

Readers' Views and Comments

Honolulu More Progressive than Many Cities in the United States

To the Editor of the ELECTRICAL WORLD:

SIR: People who have the idea that the Hawaiian Islands are covered with palm trees and tropical foliage climbing the sides of volcanic peaks, among which the Hawaiians live in simplicity, with nothing much more to do than play ukeleles, should see the electrical pages running every week in the Honolulu *Star-Bulletin*. The pages are right up to the minute, the advertising cuts and copy are as good as any used in a New York or San Francisco paper and the reading matter is supplied by the Society for Electrical Development, thus insuring its accuracy and its interest for the readers.

What the Hawaiian Electric Company, an active member of the Society for Electrical Development, says:

> We received your letter of July 13 with material for our electrical page inclosed. We were very much pleased at your promptness in complying with our request for this material.
>
> Inclosed herewith you will find several issues of our electrical page. We will endeavor to see that a copy of each issue is forwarded to you for your perusal and files.
>
> Thanking you for the interest and co-operation which you have shown in our behalf and for the interesting reading matter, which is very adaptable to our local requirements.

Last year there was a big Territorial Fair held in Honolulu. The Hawaiian Electric Company had a building of its own as a part of the fair. It asked the Society for Electrical Development for suggestions, and a six-page "special service" was sent, of which it made excellent use. Betwen 140,000 and 150,000 people visited the fair during the week. The electrical exhibits and displays proved one of the great attractions.

There are many communities in this country where the electrical interests could show a great deal more energy in their development work and the Society for Electrical Development would be glad to help them do it.

J. M. WAKEMAN, General Manager.
The Society for Electrical Development,
New York, N. Y.

Early Electric Stoves and Irons

To the Editor of the ELECTRICAL WORLD:

SIR: We thank you for forwarding a copy of the letter from W. F. Boggs, Port Angeles, Wash., which was published on page 528 of the Sept. 11, 1920, issue of the ELECTRICAL WORLD, referring to the small stove made by the American Electric Heating Corporation that he has used for twenty years.

Our customer feels that his is about the oldest hot plate in existence, which is not quite correct, as we sold thousands of small hot plates like his before 1899. Probably the greater part of them are still in everyday use, but we do not often run across one which has had more constant daily service than Mr. Boggs'.

In this connection the writer is tempted to relate an incident which happened when he was on the road, about 1908. When calling on the United Electric Illuminating Company of New Haven, Conn., the manager there said that his wife used an enamel heating-type iron which was very nearly twenty years old. It was called a St. Paul iron, and he thought that we might like to have it to put in our museum of early electric irons. I told him that we should be glad to and would give him one of our new irons, which we at that time made with enamel elements, if he would return the old St. Paul iron to us. He did send it, but instead of coming to the office it took the natural course of returned goods and was sent up to our repair department, where it was tested and returned to the United Electric Illuminating Company, with a no-charge bill and a notation that it was O. K. with no repairs necessary. The point of this story is that the St. Paul line was made by a concern which we bought out when first going into the business, and the enamel process which it used for making heating elements was superior to all others at that time and was adopted by us.

Simplex Electric Heating Co. R. P. INGALLS,
Cambridge, Mass. Sales Manager.

Radio-Telephone Concerts

To the Editor of the ELECTRICAL WORLD:

SIR: In a recent issue of the ELECTRICAL WORLD, under the heading "Another Step Toward Transoceanic Radio-Telephony," you mention the radio-telephone service to the Catalina Islands and the fact that phonograph music played on shipboard had been heard 600 miles away at St. Johns, Newfoundland.

I am sure it will be of interest to your readers to have some information regarding the permanent installation of a radio-telephone concert service which has been in operation for three months in the California Theater building at San Francisco. Here for the first time a serious attempt has been made to convey real orchestral music (not phonographic) from a fifty-piece orchestra which plays twice daily at the theater. Special microphonic instruments are placed in the pit and in the balcony of the theater, and the microphonic currents are carried to the radio-telephone room near by, whence an antenna rises to the tower of the Humboldt Bank building, about 200 ft. (60 m.) above the sidewalk. These radio concerts have been heard great distances. They are frequently picked up by ships at sea, on one occasion as far out as 1,200 miles (1,920 km.)

As a matter of record, perhaps the first radio-telephone transmission in this country was of music, in the spring of 1907, from the old building at the corner of Thirty-ninth Street and Broadway, New York, which housed the "Telharmonium" apparatus. The radio music there transmitted was first "picked up" at the Brooklyn Navy Yard by George Davis, then chief electrician in charge of radio. In 1909 radio music was sent out from my laboratory at 103 Park Avenue, New York, Mme. Mazarin of the Manhattan Opera Company singing on one occasion to an audience in Newark. A little later a temporary installation was made on the roof of the Metropolitan Opera House and music picked up by microphones on the stage was sent out.

During the summer and fall of 1916 regular nightly "concerts" of phonograph music were maintained at the High Bridge radio laboratory, this music being heard at that time as far as Buffalo. Parties in New Jersey danced to this music played 35 miles (56 km.) away.

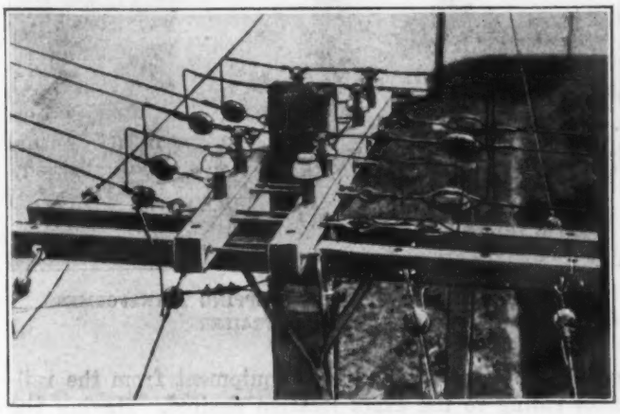
LEE DE FOREST,
President De Forest Radio Telephone & Telegraph Co.
New York City.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Egg-Shaped Insulators Prove Serviceable on Distribution Lines

EGG-SHAPED insulators such as are commonly used for guy wires are becoming popular in the West for use on distribution lines with voltages as high as 33,000. These insulators are used on the strain positions as shown in the accompanying photograph, only one insulator being used for low-voltages, while for the higher voltages several are connected in series. In these insulators the porcelain under strain is in compression, and deterioration due to tension and to temperature changes is not present as it is in cap and stud insulators. It is reported that these insulators have long life in the dead-end position.



EGG-SHAPED INSULATORS USED ON DEAD-END POSITIONS GIVE VERY LITTLE TROUBLE

Combustion Engineers Increase Plant Economy 20 per Cent

FOUR combustion engineers supervising the operation of the twenty-eight heating plants operated by the Union Electric Light & Power Company in St. Louis have during the past two years increased the quantity of steam generated per pound of fuel burned more than 20 per cent. One combustion engineer is assigned to seven plants, three of which are high-pressure generating plants and four low-pressure plants generating steam for heating purposes. A combustion engineer's duty is to keep in continuous touch with all of the important features of plant operation and control and rectify any irregular conditions. He keeps a daily check on coal used and amount of water evaporated per pound of coal; he keeps records of all operating conditions, such as draft, temperatures and CO_2 of fuel gases, and personally sees to properly sampling for analysis the coal received and the ash sent out.

The functions of the combustion engineers are independent somewhat of the general plant supervision and routine, although these engineers co-operate with the two plant supervisors, the watch engineers who are responsible for the operation of the plants as well as the firemen. The best results from the efforts of the combustion engineers were obtained from the assistance given to engineers and firemen in the form of suggestions, and it has been found that these are readily accepted if tactfully made.

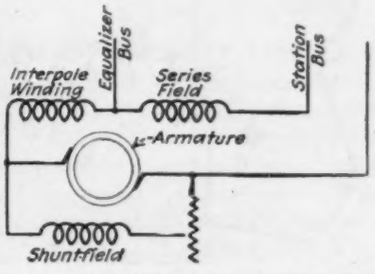
The form of the daily reports of these combustion engineers and their organization follows quite closely the duties and organization of the combustion engineers in the company's main generating station.

E. H. TENNEY,
Chief Engineer Power Plant.
Union Electric Light & Power Company,
St. Louis, Mo.

Operating Interpole Generators in Parallel

TO OPERATE an interpole generator in parallel with other machines the same arrangements must be provided as for non-interpole generators, and certain additional points must be given attention. The interpole winding must be considered as part of the armature and not as part of the series field. It must therefore not have any effect on the field strength and must neither boost nor buck the main series. This condition will be met if the brushes are set at the correct neutral position.

The equalizer connection must be made between the main series winding and the interpole winding and never to the brush bus ring direct. If the equalizer is connected to the armature terminal the equalizing current, if there be any, will flow not only through the series coils where it is wanted but through the interpole coils also. This current will make the interpoles either too strong or too weak. Usually the resistance of the interpole circuit and the series circuit is greater in proportion to the output than the resistance of the series circuit of a non-interpole machine. Consequently, when the equalizer is connected directly to the armature of the interpole machine, part of the current which should go to the interpole will flow to the non-interpole machine over the equalizer. This weakens the interpole and it does not then properly compensate for the armature reaction. Usually a machine so



PROPER CONNECTIONS FOR PARALLELING AN INTERPOLE GENERATOR

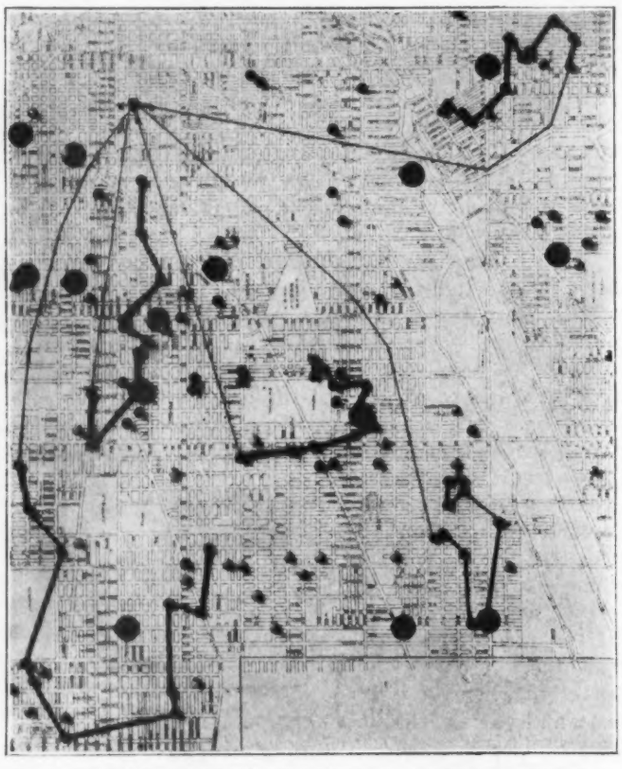
connected will not compound properly and will begin to spark at about half load owing to the weak interpole strength.

JAMES DIXON.

Cleveland, Ohio.

Map Used to Route Work of City Maintenance Crews

TO HELP the service work dispatcher lay out work for the maintenance gangs the map shown in the accompanying photograph is employed in the efficient system of the Commonwealth Edison Company, Chicago, which was described in the ELECTRICAL WORLD for Aug. 7. This particular map is for the central district of this company, similar maps being used for other districts. Service orders are indicated on the map by tacks with colored heads, a different color being used for each day in the week. Large round paper tags suspended from the tacks indicate transformer installations or changes. Minor repairs that can be done by the same gang are indicated with other kinds of tacks. These routing tacks are standard stock in map stores, and about forty varieties of heads are available. Each afternoon the service work dispatcher makes up a route for each gang on the following day by running a string around each of the tacks indicating work to be done by this gang. Service orders are given preference, and enough other repair work conveniently located is added to fill out the day's work. After work has been determined and indicated by the string, the work dispatcher arranges the service installation orders in their proper sequence and



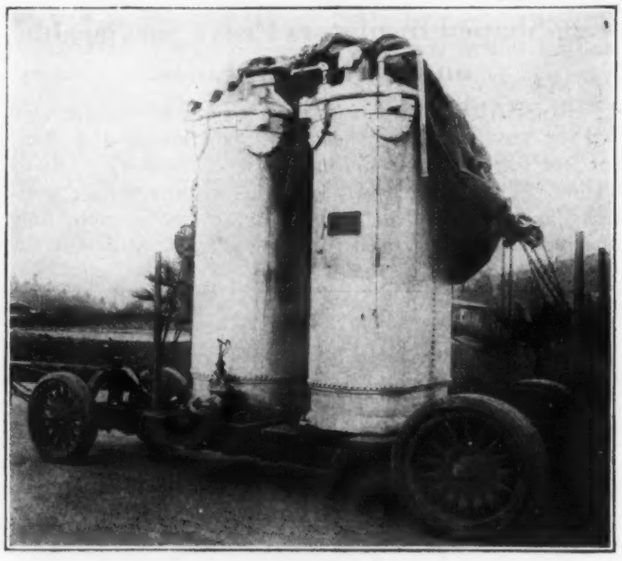
TACKS ON MAP INDICATE TRANSFORMERS TO BE CHANGED AND OTHER WORK

hands them to a typist, who prepares the daily list of orders for each of the service gangs.

D. W. ROPER,
Superintendent Street Department,
Commonwealth Edison Company,
Chicago, Ill.

A 28-Ton Auto-Trailer Hastens Transformers to Stations

IN ORDER to move heavy transformers for supplying emergency demands the Southern California Edison Company of Los Angeles designed and built an automobile trailer suitable for carrying 28 tons. This was done when it was found that shipping transformers by rail often required a week or more and left unsolved the



RAILROAD DELAYS AVOIDED BY SHIPPING TRANSFORMERS ON THIS 28-TON TRAILER

problem of getting the heavy equipment from the railroad siding to the exact location desired. Having the equipment out of service even for such a period was a serious loss during times of limited power supply.

The company, therefore, built a trailer, shown in the accompanying illustration, which has successfully handled 28-ton loads. Since it has been used there has seldom been a delay of more than twenty-four hours in moving heavy equipment over distances up to 100 miles wherever the destination could be reached over good roads, such being the case in most of the communities served by the company.

Two features of the trailer design are that it is without springs and that the forward axle is arched so that the bed is suspended by king pin and links. The bed is 18 ft. (5.4 m.) long and the over-all width is 8 ft. 3 in. (2.5 m.). The diameter of the front wheels is 36 in. (0.9 m.) and of the rear wheels 42 in. (1 m.). Wheels are equipped with solid rubber tires, the rear tires being 14 in. (35 cm.) wide. The lift to the top of the bed is 25 in. (63 cm.) and the clearance is 15 in. (37.5 cm.). When handling capacity loads the trailer is usually drawn by a 6-ton truck with 5 tons of ballast.

The first truck built by the company, at a cost of about $2,300, was in constant demand and was found to be so useful that a second one was constructed, the only change in design in the second trailer being the addition of band brakes operated by an 8-ft. (2.4-m.) lever to which a rope from the driver's feet was attached. The design has been copied by three other trucking companies.

P. H. Ducker is superintendent of transportation for the Southern California Edison Company.

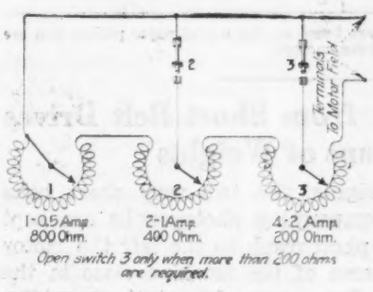
Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Connection of Rheostats for Testing

IN THE electrical testing department of a large motor manufacturer the burning out of plate rheostats used in field circuits due to overloading has been prevented by connecting them up as shown in the sketch.

As will be seen, the lowest-resistance rheostat, No. 3, which also has the largest capacity, must be all cut in the circuit first and switch No. 3 opened before No. 2 can be used. This reduces the current to a safe value for rheostat No. 2. Similarly No. 2 rheostat must be all cut in the circuit and switch No. 2 opened before rheostat No. 1 can be used. The rheostats used are the ordinary field-regulating rheostats of the plate type manufactured by the Cutler-Hammer Manufacturing Company. They are mounted on a board supported on a small platform with wheels so that they can conveniently be moved from place to place.



RHEOSTATS ARE PROTECTED BY THIS WIRING AGAINST IMPROPER OPERATION

EUSTACE C. SOARES.

Ampere, N. J.

Inserting Magnetic Slot Bridges to Improve Operation of A.-C. Machines

MAGNETIC SLOT bridges improve the operating characteristics of alternating-current generators and motors by making the density of the magnetism in the air gap and the iron nearly uniform. The advantages in operating gained by using magnetic wedges in induction motors are: Better power factor especially at light loads, less core loss, better efficiency, less exciting current and better starting ability. In generators and synchronous motors the magnetic bridge by giving uniform flux permits the use of a liberal air gap, reduces core loss, and therefore improves efficiency and allows the use of solid poles and pole shoes.

The magnetic wedge is a piece of iron or steel which fits in grooves in the sides of the stator teeth and allows the magnetism to spread out so that the density over a slot is nearly the same as over a tooth. The wedges are thin in the middle so that the iron is saturated at this point.

The bridges must be well and permanently insulated from the laminations. If "grounded" on one side only, the laminations are short-circuited and eddy currents will cause local core heating. If grounded on both sides, the bridge and laminations form a short-circuited turn interlinked with the winding, and by transformer action current will flow and heat the bridges and core. In a heavily loaded machine grounded bridges may run red hot. It is fairly easy to insulate the bridges by using a fiberoid trough and plenty of varnish to keep out moisture and oil. The grooves in the teeth of stator must be clear of all old insulation, burns and bumps. A thickness of insulating trough (bridge paper) which gives a good driving fit dry must be used. Before inserting the paper the slot grooves are varnished with the best baking varnish. The bridge paper is then placed in the slot and worked into the grooves with a blunt-nosed tool. A coat of varnish is applied to the trough, and after dipping the tip of the bridge in varnish it is started in the groove and driven to its place. After setting, the bridge is tested for grounds with at least 110 volts (220 volts if available). If a grounded bridge is found, it must be taken out and the cause must be removed.

When all the bridges are in and test clear, excess paper is trimmed off and the face of the stator is varnished, working the varnish into the slots and between the ends of bridges. The varnish should dry before running the machine. If possible, the machine should be baked in an oven.

Where there are several bridges per slot, short bridge papers can be used. On most large stators a fiber stick is placed while wet with varnish under the bridge to wedge the coil down. Bridges should not stick out endwise beyond the core as they are liable to shake loose if not held throughout their whole length. Split stators must have a fiber bridge at the split slot on each side. There is always some "working" at the splits, and it is impossible to keep metal bridges insulated there. When there are several bridges per slot they should be set about $\frac{1}{16}$ in. (1.5 mm.) apart. Where slot grooves are badly mangled fiber or wood bridges should always be used.

JAMES DIXON.

Cleveland, Ohio.

Synchronous Motor Advantages Compared with Induction Motors

DETERMINATION to change the phase-wound-rotor type induction motors to the synchronous type in a Southern plant was made for the following reasons:

1. No sacrifice in original rated capacity of the motor. The use of increased field current would, of course, permit a certain amount of overload.
2. A combination of good starting torque of the induction motor with the constant-speed characteristics of the synchronous motor.
3. Adequate stability of operation with change of load.
4. Improved system power factor, with motor in question having inherent leading-power-factor characteristics.

Standard Pulley Sizes for Motors Recommended by Power Club

STANDARD pulley sizes for fractional-horsepower and large power motors have been adopted as recommended practice by sub-committees of the Electric Power Club, the sizes being as shown in the accompanying tables.

TABLE I—PULLEY DIMENSIONS FOR FRACTIONAL HORSEPOWER MOTORS

Flat-faced pulleys: Diameter, In.	Face, In.	Bore, In.
3½	2½	⅝
3	2½	½
2½	1¼	½
Grooved Pulleys: Pitch Diameter, In.	Belt Diameter, In.	Bore, In.
2	¼	½
1¾	⅛	½
1½	⅛	½

NOTE.—The 1¾-in. ⅛-in. pulley, when used with a ¼-in. belt, gives pulley dimensions of 1½-in. by ¼-in. Grooved pulleys should be arranged for mounting upon the shaft provided with a flat and secured by a set screw.

For the fractional-horsepower motors standard shaft diameters, keyways and set-screws have also been adopted.

TABLE II—SHAFT, KEYWAY AND SET-SCREW DIMENSIONS FOR FRACTIONAL-HORSEPOWER MOTORS

For flat or crowned-faced pulleys: Shaft Diameter, In.	Key
½	3/32 sq.
⅝	3/32 sq.
Flat and set screws for grooved pulleys: Shaft Diameter, In.	Set Screw Dimensions
½	5/32-in.—24-thread set screw
⅝	5/32-in.—24-thread set screw

The pulley sizes shown for large motors are for open and semi-inclosed alternating-current single-phase and polyphase and direct-current, constant-speed, continuous-duty motors.

The tables for fractional-horsepower motors are for continuous duty, constant-speed motors, irrespective of ratings.

TABLE III—PULLEY SIZES FOR POWER MOTORS

For open and semi-inclosed, alternating-current, single-phase and polyphase, and direct-current, constant-speed and continuous-duty motors. (Dimensions are in inches.)

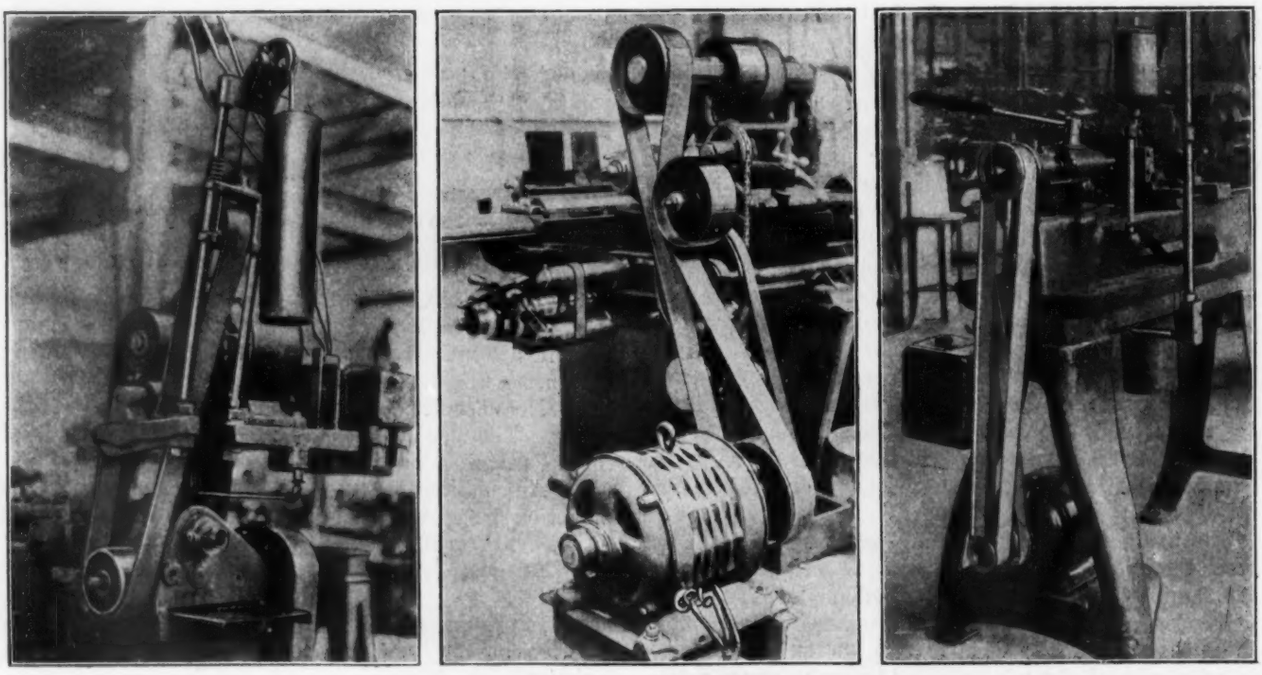
Hp. at 1750-1800 R.p.m	Hp. at 1150–1200 R.p.m.	Hp. at 850–900 R.p.m.	Pulley Diam., In.	Pulley Belt, Width, In.	Bore, In
½	¾	...	3	2	½
1½	1	...	4	3	½
2	1½	...	4	3	⅝
5	3	...	5	4	1¼
7½	5	3	5	4	1¼
10	7½	5	6	5	1⅜
15	10	7½	7	6	1⅜
20	15	10	8	6	1½
25	...	...	9	7	1¾
30	20	15	9	7	1¾
40	25–30	20–25	10	7	2¼
...	40	30	11	10	2¼
...	50	...	12	11	2¼
...	60	40	12	11	2¾
...	75	50	13	12	2¾
...	...	60	13	12	2¾
...	100	75	15	14	3¼

NOTE.—These pulley sizes are based on the use of paper pulleys and are applicable to either 40 deg. or 50 deg. motors.

Removing Slack from Short Belt Drives by Means of Weights

BY MEANS of weights, the two very short belts shown in the accompanying photographs are kept always tight. In the photograph to the left the motor is mounted on the frame of the machine close to the pulley to be driven. By means of a stationary idler pulley and the idler pulley which travels on the two slide rails the belt is arranged to give a large contact area, and the weight keeps sufficient pressure on the belt to prevent slipping.

In the center there are two belt drives, the main one of which is kept tight by means of the idler pulley, which is held down by a weight hanging over the chain just to the right of the pulley. At the right is an example of compact mounting of motor and control. These machines are in the Westinghouse Electric & Manufacturing Company's factory, East Springfield, Mass.



WEIGHTS ON IDLER PULLEY KEEP SHORT BELT DRIVES TIGHT

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Denver Company Sells $40,000 Worth of Washing Machines in Thirty Days

A THIRTY-DAY washing-machine campaign was conducted by the Denver (Col.) Gas & Electric Company during June and 300 machines were sold. Sixteen salesmen were used, assigned to thirteen residential and three business districts. In addition, about $5,000 was spent in newspaper advertising. Clare N. Stannard, secretary and commercial agent of the company, believes that the plan of intensive personal solicitation combined with judicious advertising is the most effective for special campaigns. He has demonstrated this theory successfully in the execution of the vacuum-cleaner campaigns which he has conducted with marked success during the last few years. His semi-annual campaigns have resulted in the sale of about 12,000 cleaners in the city of Denver.

New Angle from Which to Look at Rate Theories

BY KASSANDRA

THERE are two main theories of rates. One is based on the old-fashioned law of supply and demand and maintains that the rate for each quantity and class of service should be fixed by competition. If such rates lead to a greater than a fair return on the total investment then again the law of supply and demand leads to an increase in the investment and service and a general lowering of rates until an equality between supply and demand is again reached.

The other theory of rates maintains that the cost of each quantity and class of service can be computed by some formula, as, for instance, by assigning to each class some proportion of the fixed costs, some proportion of the customers' costs, some proportion of the energy costs, some proportion (usually an average) of the distance costs, etc.

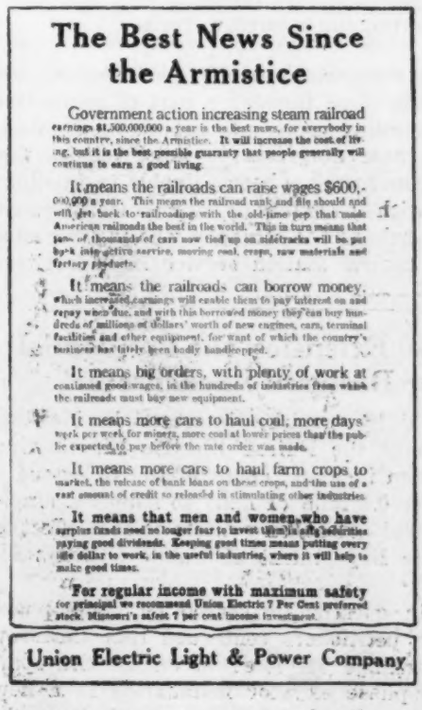
If the two theories lead to the same rates, as they often do, then there is no test as to which theory is right or best. But suppose the competitive or supply and demand theory gives a rate of say 3 cents for a definite case (which under this theory would be only just under what that class could pay) while the so-called cost theory leads to another rate, say 5 cents or 2 cents. If the cost theory leads to a rate of 5 cents or higher than the competitive theory, of course the customers will not take service, but will secure it elsewhere, and the central station will lose the economy it might get from the greater output.

If, on the other hand, the formula used in applying the cost theory leads to a rate of 2 cents the customer will take the service rather than supply himself otherwise, but is not this profiteering on the part of the customer? The customer would pay the equivalent of 3 cents if he got the service elsewhere, and this presumably would enable the customer to make just a fair profit in his own business. For the central station to supply at 2 cents would then enable the customer to make more than a fair profit in his own business, and he is apt to become a profiteer.

If the customer is another public utility it may refuse to take the unfair profit and pass it on to its customers, but even then why should these customers of the other utility get the profit rather than the customers of the central station? Is it not better that, to prevent profiteering, the central station should keep the rates at (or just below) the competitive level, and should use its profits not for its stockholders but in extending the service so as to serve more of the public with the maximum of service at a fair price, rather than to serve a selected class of consumers at lower than a fair price?

The latter plan results in the selected class becoming profiteers and injures the rest of the public, while the application of the competitive theory results in the greatest good for all.

Increased Freight Rate as Argument for Sale of Stock



The Best News Since the Armistice

Government action increasing steam railroad earnings $1,500,000,000 a year is the best news, for everybody in this country, since the Armistice. It will increase the cost of living, but it is the best possible guaranty that people generally will continue to earn a good living.

It means the railroads can raise wages $600,000,000 a year. This means the railroad rank and file should and will get back to railroading with the old-time pep that made American railroads the best in the world. This in turn means that tens of thousands of cars now tied up on sidetracks will be put back into active service, moving coal, crops, raw materials and factory products.

It means the railroads can borrow money, which increased earnings will enable them to pay interest on and repay when due, and with this borrowed money they can buy hundreds of millions of dollars' worth of new engines, cars, terminal facilities and other equipment, for want of which the country's business has lately been badly handicapped.

It means big orders, with plenty of work at continued good wages, in the hundreds of industries from which the railroads must buy new equipment.

It means more cars to haul coal, more days' work per week for miners, more coal at lower prices than the public expected to pay before the rate order was made.

It means more cars to haul farm crops to market, the release of bank loans on these crops, and the use of a vast amount of credit to relaunch in stimulating other industries.

It means that men and women who have surplus funds need no longer fear to invest them in safe securities paying good dividends. Keeping good times means putting every idle dollar to work, in the useful industries, where it will help to make good times.

For regular income with maximum safety for principal we recommend Union Electric 7 Per Cent preferred stock. Missouri's safest 7 per cent income investment.

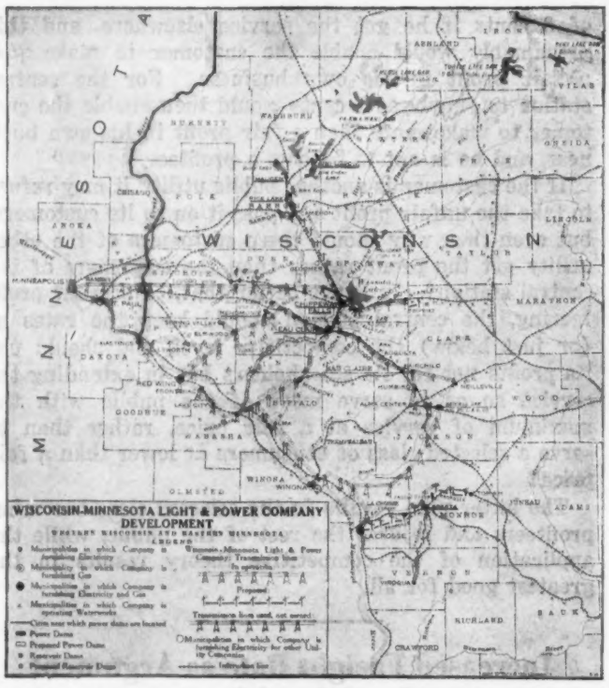
Union Electric Light & Power Company

AN example of broad-gaged public policy advertising is shown in the accompanying advertisement of the Union Electric Light & Power Company of St. Louis, which appeared in the daily papers of that city. The advertisement ostensibly uses the news of the increased railroad freight rates as an argument to sell the company's stock, but in reality tells the people that they are the ones who profit when public utilities are allowed to charge rates which are high enough to pay for the quality of service which the public expects.

Showing the Public Extent of Territory Served

A DIAGRAM of a transmission system framed and hung in a conspicuous place in hotel lobbies is a method of central station publicity that the Wisconsin-Minnesota Light & Power Company is employing in its advertising.

The system diagram used is shown herewith. On



THE WISCONSIN-MINNESOTA LIGHT & POWER COMPANY PLACES IN HOTEL LOBBIES FRAMED COPIES OF THIS MAP SHOWING THE TERRITORY SERVED

the original the circuits owned by the company are shown in red while those forming a part of connecting systems owned by other companies are shown in black. The placing of these diagrams in hotel lobbies frequented by business men has been valuable in familiarizing the public with the extent of an important system and is a decided help to the stranger who is interested in knowing the central station service in a territory new to him.

Three-Phase Extension for Residential Elevator Declared Burdensome

AN ATTEMPT by wealthy interests in Newton, Mass., to force the Edison Electric Illuminating Company of Boston to spend about $2,200 to extend a three-phase feeder 0.6 mile (1 km.) to supply a single electric elevator met defeat, on petition to that effect to the Massachusetts Department of Public Utilities recently.

The district in question is served by single-phase circuits, and the petitioners contended that the company should rearrange its lines to enable the operation of a three-phase elevator installation in a new residence, bearing all of the expense of the construction.

The company offered to build the line on a basis by which its cost would be rebated from the bills of the petitioner from year to year until paid for, but an agreement could not be reached. In its finding the commission declared that there was no evidence that any other customer required this type of service and that the cost would have to be borne by the small users of service if put upon the company. The use of a motor-generator set was suggested as a means of obtaining the desired elevator service.

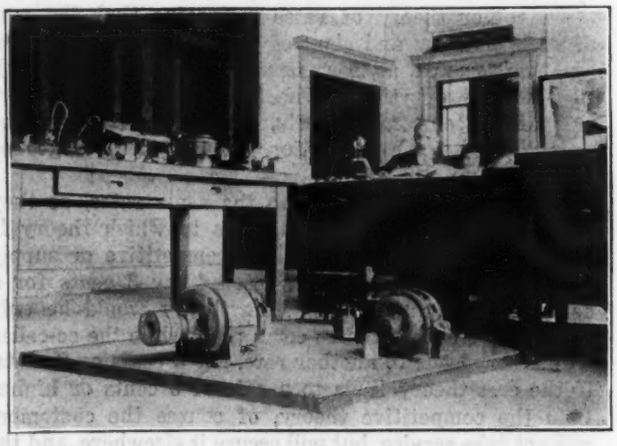
Employers Warned to Carry Compensation Insurance

EMPLOYERS who come under the workmen's compensation law of New York State are being warned by Bernard L. Shientag, chief counsel to the State Industrial Commission, to carry compensation insurance to cover their employees. Failure to do so, Mr. Shientag points out, is a misdemeanor punishable by a fine up to $1,000, by imprisonment up to one year, or by both such fine and imprisonment. The Industrial Commission through its counsel will proceed vigorously against any employer who continues to disregard this law.

Any employer who is in doubt as to his duties under the workmen's compensation law should apply to the Industrial Commission, at its office, 124 East Twenty-eighth Street, New York City. "If an employer continues to violate this law, he may expect very little consideration from the commission and from the courts," said Mr. Shientag. In the last year the Court of Special Sessions imposed fines ranging from $50 to $250 on 122 employers failing to carry compensation insurance, and one uninsured employer in whose plant a worker was seriously injured was sent to jail for thirty days.

Composition Platforms for Motor Displays

CLEANLINESS and quiet in handling small motors in the office of the Hartford (Conn.) Electric Light Company are assured by using a platform of composition floor material, illustrated herewith, upon which motors



PLATFORM, FOR DISPLAYING MOTORS, COVERED WITH COMPOSITION MATERIAL

may be moved about freely. The platform is 2 in. (5 cm.) high, 72 in. (1.83 m.) long and is 56 in. (1.42 m.) in width.

The convenience of displaying small motors in this way instead of on a granolithic or other hard flooring serves both neatness and flexibility.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Rating of Motors for Intermittent Work.—ADLER AND SCHIEBELER.—The rating of a machine is usually determined by the temperature rise during load tests. Motors are often tested for temperature rise on a one-hour run. When the motor is intended for intermittent service, however, it may safely be loaded far beyond the continuous one-hour rating. The authors discuss the factors which affect the performance and heating of motors for intermittent work and suggest that methods be standardized for intermittent testing. A modification of the standardization rules of the V. D. I. is drafted, three types of loading being defined: Continuous loading, occasional, or brief loading, and intermittent loading, and tentative rules for the testing of motors for these three types of service are laid down. For intermittent-load motors the authors suggest a test cycle of three minutes full (intermittent) rated load, followed by a nine-minute total test, this cycle to be repeated during any such length of time as the parts may stipulate, and the tested motor not being permitted to heat up over a certain temperature. According to the authors such a machine should also have on its numberplate a short-time rating, based on a thirty, forty-five, sixty or on a ninety minute continuous-load run.—*Elektrotechnische Zeitschrift*, June 24 and 30, 1920.

Induction Type Frequency Changer.—HARRY S. SMITH.—The author describes a two-machine induction type frequency changer in which one is commonly a standard wound-rotor polyphase induction motor and the other a direct-current machine, used to drive the rotor of the induction machine at the proper speed for any frequency. The underlying theory of this type of frequency changer is discussed.—*Electric Journal*, August, 1920.

Lamps and Lighting

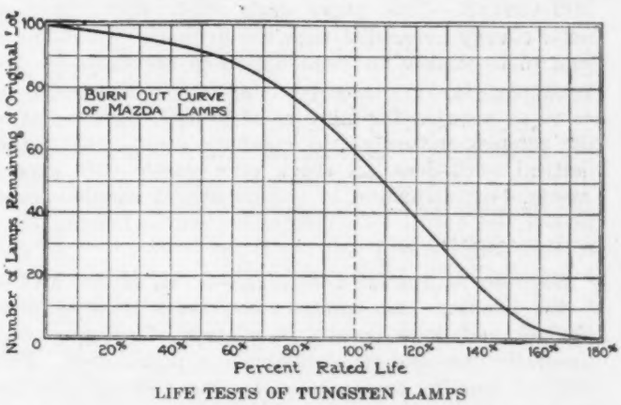
Maintenance of Electric Lighting Equipment on the Lincoln Park System.—C. H. SHEPHERD.—On a system which consists principally of 400-watt gas-filled lamps enclosed in 20-in. (50-cm.) globes, the author states that the life of the gas-filled lamp varies from 1,000 to 12,000 hours. Three types of continuity equipment in use are the film cutout, the compensator and the series-multiple transformer systems. The lamp record, which consists of a card for each particular standard throughout the system, is kept showing the location of the standard, type of filament, make of lamp, date of installation, date of burnout or breakage, and other necessary information on the face of the card, while on the back of the card is given the electrical characteristics of the transformer, compensator or film cutout which serves the lamp. It is said that the cash cost of operating this system is about 50 per cent below the cost of the original arc lamp system which was in service about five years ago. Difficulty due to the accumulation of dirt and insects is taken care of by means of an air tank operating from an initial pressure of 105 lb. (7 kg. per square centimeter).—*Transactions Illuminating Engineering Society*, July 20, 1920.

Theory and Characteristics of Incandescent Lamps.—HENRY SCHROEDER.—An interesting summary of the chief characteristics of modern incandescent lamps. The table gives the temperature data of various filaments:

Lamp Filament		Approximate Operating Temperature	Approximate Melting Temperature
Carbon	60 watts, 220 volts (untreated)	1870 deg. C.	4000 deg. C.
	50 watts, 110 volts (treated)	1930 deg. C.	
Tungsten	25 watts, 110 volts (vacuum)	2150 deg. C.	3300 deg. C.
	500 watts, 110 volts (gas-filled)	2500 deg. C.	
	30 volts, 30 amperes (gas-filled)*	3000 deg. C.	

*Motion picture lamp.

The curve indicates typical results of life tests of tungsten lamps showing that, of the number tested,



LIFE TESTS OF TUNGSTEN LAMPS

60 per cent burned for the full rated life.—*Bulletin L. D.* 114, *Edison Lamp Works*, June, 1920.

Generation, Transmission and Distribution

Recent Tendencies in Cable Manufacture.—H. SAVAGE.—It is stated by the writer that the British have led in the development of satisfactory cables for underground transmission, for the reason that underground transmission is so commonly adopted in England. It is said that impregnated paper has proved its value by being used to an enormous extent for all pressures and conditions, and that it is the only really reliable and satisfactory dielectric for extra high pressures. The only serious competitor is vulcanized bitumen, which has lately emerged into an article of general manufacture and use. Its rise is mainly due to the extension of electricity in the mining industry. Being neutral to the peculiar moist conditions in mines, independent of a heavy sheath, semi-flexible, and not requiring the skilled care of a hydroscopic dielectric, it has found acceptance among colliery managers. It is also held that the steady rise in working pressures from 3,000 volts to 30,000 volts has not produced any drastic change in cable

materials, but has been met by a certain increase in thickness, greater care founded on experience in manufacture and a reduction in the ratio of test to working pressure. Grading of the dielectric to minimize the potential gradient in the dielectric has not yet fulfilled the anticipation of its authors, it is said. The author points out the gradual disappearance of the large single-core cables with hollow centers which were prominent some years ago when single-phase alternating current was in the ascendant and which were designed to minimize the so-called "skin effect."—London *Electrician*, July 2, 1920.

Traction

Overhead Construction for Electric Railroads.—REISHAUS.—The article is profusely illustrated and gives a rather complete account of all more representative systems for overhead construction which have been employed by the Siemen-Schuckert-Werke in various European electrifications. Particular attention is given to problems of multi-track roads and yards, and to different systems for keeping the contact wire automatically under proper tension at all times.—*Elektrische Kraftbetriebe und Bahnen*, June 24 and July 4, 1920.

Installations, Systems and Appliances

Energy in the Magnetic Circuit of a Magneto.—N. W. MCLACHLAN.—This paper deals solely with the magnetic energy associated with the primary circuit and is said to be merely an introduction to the subject. The treatment is very approximate, but is suggested to serve as a guide for more exact study. On account of the complex nature of the magnetic circuit the mathematical work does not check very closely with experiments, but, according to the author, it should, nevertheless, be useful in a qualitative way.—London *Electrician*, July 30 and Aug. 6, 1920.

Bonding in Special Locations.—G. H. MCKELWAY.—Cross bonding and special connections to structures, bridges and poles constitute a class of bonding very generally used and requiring care in installation. This type of bonding is discussed by the author.—*Electric Railway Journal*, Aug. 21, 1920.

Electrically Deposited Thermocouples.—A method of constructing thermocouples in which one of the elements is deposited electrically on a core, which constitutes the other element of the couple, is described. In particular the couples investigated are those in which constantan is used with either silver or copper. The process is ascribed to W. Hamilton Wilson and T. D. Epps.—*London Engineer*, Aug. 6, 1920.

Electrophysics and Magnetism

Quantum Emission Phenomena in Radiation.—DAVID L. WEBSTER.—A comparison of X-rays and light are given covering the best known cases of excitation of line spectra by electron impact and the form of the Bohr theory that is required by them. These phenomena are compared with corresponding absorption phenomena with especial reference to the accumulation of energy for photoelectrons by absorption. It is said that theories of the type of Bohr's appear inconsistent with these facts. The phenomena suggest that the law of the conservation of energy as applied to atomic oscillators holds only statistically. A set of postulates to replace it for individual oscillators is outlined.—*Physical Review*, July, 1920.

Units, Measurements and Instruments

Note on Radio Frequency Measurements.—CARL ENGLUND.—After discussing the need for a radio-frequency bridge of general utility, the bridge method is critically compared with indicating, null and potentiometer methods. Certain precautions in the shielding and coil construction of such bridges are considered, and the specific form of bridge used by the author is described in detail. Beat note with amplification and telephone indicator of balance point are used. Some applications of the bridge are then given.—*Proceedings Institute of Radio Engineers*, August, 1920.

A Potentiometric Control Rheostat.—J. DAMIEN.—It is sometimes essential in current-adjusting resistances—for instance, field rheostats—that the current shall increase by just the same amount for every step on the rheostat. Such characteristics are easily obtained in a rheostat built on the drop-wire principle. The author shows how the successive resistance steps must be graded in order to give the desired straight-line relation, and gives a method for computing the separate steps. In a certain numerical example, which is dealt with in detail, it is found that while the first few steps must be rather small, the number of ohms per step reaches a peaked maximum at about one-third of the range and then decreases to even lower values than those of the first steps. On the other hand, if a drop-wire rheostat with equal resistance steps is used, the current increments will be found to pass through a rather flat minimum around the mid point of the range.—*Revue Générale d'Electricité*, June 26, 1920.

Telegraphy, Telephony and Signals

Measurements of the Electromagnetic Field of Waves Received During Transoceanic Radio Transmission.—GIANCARLO VALLAURI.—A series of recent experiments is described on the determination of the electric and magnetic field intensities of the waves received at Leghorn, Italy, from the Annapolis transmitting station. A pair of large loops, respectively practically parallel and perpendicular to the incoming wave, are used. The incoming signals are received by heterodyne oscillator and amplified. A substitution method is used for the measurements, whereby the incoming signal is compared to an artificial signal produced in the non-receptive loop by a local oscillator. A thermocouple and galvanometer in the oscillator circuit, together with a calibrated mutual inductance for coupling to the non-receptive antenna, permit quantitative results. Numerical results are also given and it is shown that the field strengths of the incoming waves are much greater than those calculated by the usual transmission formulas.—*Proceedings of the Institute of Radio Engineers*, August, 1920.

Miscellaneous

Coal and Water in the United States Compared as Sources of Power.—R. S. MCBRIDE.—Data are given concerning the water power resources of various states of the union and the distribution of coal deposits by districts.—*Coal Age*, Aug. 12, 1920.

Organization of the Electrical Industry.—C. H. WORDINGHAM.—The author points out the desirability that engineers shall have some body which will represent their interests when questions of both external and internal policy have to be decided. He outlines the possible usefulness and organization of such a senate.—London *Electrician*, April 30, 1920.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

CONCRETE MIXTURES, PROPORTIONING OF.

A method of proportioning concrete mixtures is being developed based on the theory that the quantity both of cement and water required to give concrete of a workable plasticity depends upon the surface area of the aggregate used. By this method it is possible to fix the portions of the constituent materials of a concrete mixture, namely, cement aggregate and water, so that a concrete of definite strength will result while at the same time the mixture will have a predetermined degree of plasticity. Results to date have been very encouraging and this method is now being given a practical tryout on several works of large size.—*R. B. Young, Hydro-Electric Power Commission Laboratories, Toronto, Canada.*

FREQUENCY BRIDGE.

An arrangement of capacity, mutual inductance and resistances, consisting essentially of a Heaviside bridge, has been developed for the accurate determination of frequency in the audible range. A telephone may be used as a balance indicator, or better a vibration galvanometer, and the frequency is obtained by the usual formula, $\omega^2LC = 1$. In this expression the value of the mutual inductance multiplied by the ratio of the two resistances must be added to that of the primary inductance. The resistance ratio may be taken large, say 30:1, and thus low frequencies measured without prohibitively large condensers and inductances. Losses in the condensers do not affect the result, nor does the inductance in the resistances, but adjustment of an auxiliary small variometer is necessary for a sharp balance. Using a vacuum-tube oscillator, giving about 1,000 cycles, results which check to five significant figures have been repeatedly obtained with this bridge, incidentally showing the great constancy of conditions obtainable with such an oscillator. The bridge has also shown that rather small changes in the secondary load of the oscillator cause considerable changes in the frequency. An investigation regarding its adaptability to commercial frequencies is in progress.—*Edy Velander, Harvard University, Cambridge, Mass.*

LAMPS, INCANDESCENT, FOR SIGNAL FLASHING.

In a study of incandescent lamps for use in daylight signaling by the United States Signal Corps the following results have been obtained: (1) The time required for a filament to heat to approximately its maximum brightness exceeds greatly the time required in cooling to effectively zero brightness; (2) the higher the maximum temperature of a flash, the greater is the speed of the flash; (3) the smaller the filament, the greater is the speed of the flash; (4) the less the resistance in a circuit external to the flashing lamp, the greater is the speed of the flash; the speed of flashing for a given filament at a given temperature in various atmospheres—including in vacuo—is the greater the greater the gas loss; (6) for lamps of the same open-filament construction in various atmospheres, such that they possess the same luminous flux and the same average life at the same fixed voltage, the speed of flashing is the greater the greater the gas loss.—*A. G. Worthing, Nela Research Laboratory, Cleveland, Ohio.*

LAMPS, LUMINOUS-ARC.

Luminous-arc lamp efficiencies have been increased by the compounding under high pressure of the ingredients of the electrodes. It is reported that by this means 30 to 40 per cent more light is produced than with the previous standard electrodes, with at least equal life. For the same light as formerly increased life of the electrodes is expected.—*A. I. E. E. Committee on Lighting and Illumination.*

PAINTS, INDICATING TEMPERATURE.

An examination is being carried out into the characteristics of indicator paints; that is, paints which change their color with the temperature. This investigation covers their critical temperature, the permanency of characteristics, the number of reversals, the commercial availability and the possible advantage of using these paints on bearings of electrical apparatus, oil coolers, etc.—*H. Logan, New York City.*

PROTECTIVE DEVICES, BEHAVIOR OF, DURING DISTURBANCES.

An unusually large percentage of the larger operating companies have experienced severe system disturbances, and in some cases the behavior of the protective devices was an important factor in the disturbances. A sub-committee is now endeavoring to formulate some standard method of reporting on such matters, so that the reports can be properly condensed, summarized and made available for further study.—*Protective Device Committee of the A. I. E. E.*

STANDARD CELL, CADMIUM, IMPROVEMENTS IN.

Instead of the soft glass ordinarily used for the container a hard Corning glass G702P was used, which is much less soluble than ordinary soft glass. Further, this glass seals directly to tungsten and ordinary porcelain. Tungsten is substituted for platinum leading-in wires, and of the seventy or more cells made up and tested there has been no case of cracking of the terminals, while the mortality with platinum in ordinary glass would have been several per cent. The emfs of the cells tend to run very uniform, possibly a little high. Some other new designs are being developed so as to give a greater portability and more compact form. A disk of porous porcelain is sealed into the glass permanently to separate anode and cathode salts. In one form one electrode is an annular ring surrounding the other.—*T. Spooner and C. J. Rottman, East Pittsburgh, Pa.*

SYNCHRONOUS MOTOR, PROPERTIES OF V-CURVES.

The locus of all points on the V-curves of the synchronous motor, where the tangents to the curves are vertical, is a hyperbola which is conjugate to the hyperbola which is the locus of all points at which the tangents to the curves are horizontal. The hyperbola first mentioned divides the figure into two parts, in one of which, below the hyperbola the operating conditions are stable, and in the other, above the hyperbola the operating conditions are unstable.—*A. S. Langsdorf, Washington University, St. Louis, Mo.*

Suggestions for Research

ALTERNATORS, FIRES IN.

A number of destructive fires have occurred of late years in large turbo-alternators, with resultant losses and interruption in service. The modern inclosed construction of the alternator, the forced air draft and the high operating temperature seem to be particularly conducive to such fires. Systematic research is needed (a) into the undesirable elements of construction, (b) into dangerous operating practices, (c) into the best means for minimizing the possibility of a fire and checking its speed. —*Editorial Suggestion.*

CUT-OUTS, PRIMARY, FOR LINE TRANSFORMERS.

One of the largest operating companies some years ago abandoned the use of all types of cut-outs or lightning arresters which were inclosed in an iron case. This was found necessary on account of the troubles with these devices during rainstorms and wet snowstorms. The difficulty increased with the size of the generating or transforming units which supplied the current to the lines on which these devices were installed. In the past year another large operating company has taken exactly the same action and for the same reason. It is recommended that operating companies take note of this situation, because with the increase in the size of their generating and transforming units they will ultimately be called upon to take similar action and they should therefore investigate types of such devices without the metal inclosing case with a view to its adoption for their future work.—*Committee on Protective Devices of the A. I. E. E.*

ELECTRON EMISSION, PREVENTION OF.

During the last few years an intensive study has been made of the surface conditions of wires necessary to produce the emission of electrons, and this study has resulted in the high state of efficiency of the present electron tube. Nothing short of a similar study of the surface conditions of wires necessary for preventing the emission of electrons, instead of producing them, will finally give us the wire conductor of the future, for use with high-frequency carrier oscillations.—*G. O. Squier, War Department, Washington, D. C.*

IGNITION, HIGH-TENSION LEADS FOR.

Some trouble has been experienced with the ignition of gas engines when the high-tension leads from the spark coil to the distributer are placed in the same metal conduit with the leads from the distributer to the spark plugs. Apparently the electrostatic capacity of the lead to the ground draws an appreciable charging current from the coil and causes an excessive drop of voltage, thus leaving an insufficient voltage for the spark. Whatever the explanation may be, a careful experimental and theoretical investigation is desired, with recommendations as to the best arrangement of the leads.—*Editorial Suggestion.*

PORCELAIN, POROSITY TEST OF.

Tests to determine porosity in insulator units at the factory are needed, and the man who develops a method whereby we can detect porous insulators at the factory without destroying them will be a true benefactor of the transmission engineers and porcelain manufacturers.*—*W. D. A. Peaslee, Huntington, W. Va.*

*A.I.E.E. *Journal*, 1920, page 445.

TELEPHONE RECEIVER, INCREASE IN SENSITIVENESS.

As a result of some experiments, W. Kunze believes that the static sensitiveness with direct current of a telephone receiver may be increased many times by using a separately excited and laminated iron core in place of the permanent magnet.—*Archiv für Elektrotechnik*, 2, page 495 (1914).

Further experiments with alternating-current excitation are desired to confirm or to disprove the practicability of this suggestion.—*Editorial Suggestion.*

WOOD AS INSULATOR.

Dry wood is a good insulator, but in order to keep the wood dry its pores must be filled with some non-hydroscopic insulating compound. The proposed research would fall under several heads: First, methods for abstracting all moisture from the wood; second, the best method of forcing a suitable compound into the pores of the wood; third, determination of the best insulating compound for the purpose.—*H. H. Cochrane, Butte, Mont.*

ASSIGNED coal cars for public utilities are expected to be continued by order of the Interstate Commerce Commission. The New England priority order, however, will, it is thought, not be extended.

OF A DAILY average of 4,100 cars loaded with coal in the central region of the Pennsylvania system in a recent week, 2,200 were assigned cars, and of these more than 800 were assigned to public utilities.

MATERIAL improvement is reported in the coal situation in Ohio so far as the supply to public utilities is concerned.

SIX HUNDRED coal cars with a carrying capacity of 55 tons each have been ordered by the Public Service Electric Company of New Jersey in order to insure a continuous supply of fuel at its plants.

DIFFICULTY in obtaining coal supply for utilities may be expected to persist for several years in the opinion of Vice-President Morrow of the National Coal Association, as expressed before the Pennsylvania Electric Association.

UNWILLING to purchase coal at prevailing high rates, the Ohio Utilities Company recently closed down its plant at Delaware, Ohio, without warning its consumers, forcing a temporary suspension of many of the industries of the place.

INTERRUPTIONS to the service of the Rockford (Ill.) Electric Company were occasioned one morning recently by the poor quality of coal available and continued until a better grade could be obtained.

VALUATIONS made in 1919 and based on the average prices for the five years preceding Jan. 1, 1916, have been found by the Supreme Court of New Jersey to be unfair to the public utilities affected, and the cases have been remanded to the Public Utilities Commission for an increase in rates based on present-day costs.

THE FIRST applications for licenses to be advertised by the Federal Power Commission were made by the Ford Motor Company, Troy, N. Y., and the State of Illinois.

DEVELOPMENT of Alaskan water power in the timber area in order to make available 40,000,000,000 ft. of paper-pulp material is urged by the United States Forestry Bureau.

THE TOTAL production of electrical energy for the first six months of 1920 is put by the Geological Survey at 8,274,295,000 kw.-hr. These figures are based on reports from 3,000 power plants.

BUSINESS is reported as quiet in all sections of the country except the district around Portland, Ore., where sales are good. A heavier volume of buying is, however, looked for everywhere in the near future. Rain is thought to have injured the cotton crop, and this has caused some pessimism in the South, despite general prosperity there. Slower collections except in the Intermountain States are reported. Few price changes are noted. Transportation is better, and stocks in most lines are growing in volume.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

REGULATORY commissions, declared Vice-President Young of the General Electric Company to the ELECTICAL WORLD, should show clearly to utilities and consumers what they will gain by increasing the efficiency of operation and what will be the increased cost of service if various public demands are met.

AN INCREASE in rates to large power users is to be made by the Dallas Power & Light Company in the interest of the smaller consumers.

DECLARING that the electric railways of the country need between them $300,000,000 and $400,000,000 for betterments and rehabilitation and $200,000,000 a year income, John H. Pardee, president of the American Electric Railway Association, asserts that credit can best be restored by regulatory bodies permitting flexible rates.

MARKED improvement in labor conditions throughout the country is revealed by a comprehensive survey in all sections. More workmen, fewer strikes and an improvement in individual efficiency are reported. Release of workmen by other industries makes it less difficult for electrical manufacturers to keep a full force together.

AT THE second session of the Northwest Electric Light and Power Association's convention at Spokane, Wash., the new Technical Section presented a comprehensive report, and many operating and other central-station problems were discussed.

THERE is a tendency for utilities to engage in long rather than short-term financing, according to D. C. Johnson, utility expert of the National City Company, who points out that long-term financing is the less costly.

CHANGES have been brought about which are expected to prevent large turbine unit troubles, it was brought out at the convention of the Association of Edison Illuminating Companies held this week at New London, Conn.

DETAILS of a contract for joint use of poles by power, telephone and telegraph companies where the voltage is above 5,000 were outlined at the convention of the Pennsylvania Electric Association.

A THREE-DAY practical demonstration of industrial electric lighting was staged at Nela Park, Cleveland, for electric supply jobbers.

CONVERTIBLE securities are finding public favor, according to O. B. Wilcox, chairman of the public utility committee of the Investment Bankers' Association.

A SPECIAL election upon a constitutional amendment placing all public utilities within the state under commission regulation will be held in Nebraska next week.

EDUCATION of the public both by the utilities and by the state commissions is necessary to dispel the long-existing popular suspicion, according to statements made by members of state regulatory commissions at the Nebraska Section, N. E. L. A., convention.

A SLIDING scale of rates involving bonus and forfeiture in proportion with increase or decrease in efficiency was advocated at the convention of the Indiana Electric Light Association.

AT LEAST 60,000 members of engineering societies are expected to be represented at the November meeting of the American Engineering Council.

FINANCE and regulation were the main topics at the joint convention of the Colorado Electric Light, Power and Railway Association and the Rocky Mountain Geographic Division of the N. E. L. A.

MANY technical and commercial topics were discussed by the 400 delegates who attended the convention of the New England Geographic Division, N. E. L. A.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Interest in Federated Societies Growing

THREE more local societies and one national society have indicated that they will send delegates to the November meeting of the American Engineering Council. The joint conference committee sent invitations to join the Federated Engineering Societies to associations with an aggregate membership of around 120,000. The committee is of the opinion that at the November meeting at least 60,000 of this membership will be represented by delegates. Already membership has been applied for or favorable replies received from societies with a combined membership considerably in excess of 30,000.

Representatives have been appointed by the American Society of Mechanical Engineers to the American Engineering Council to serve until Jan. 1, 1923. In addition to President Fred J. Miller and President-elect E. S. Carman, the following were chosen, representing virtually every section of the country: L. P. Alford, R. H. Fernald, A. M. Greene, Jr., W. B. Gregory, W. A. Hanley, D. S. Kimball, Charles T. Main, L. C. Nordmeyer, V. M. Palmer, H. P. Porter, A. L. Rice and Paul Wright.

Ford Water-Power Application First to Be Advertised

THE first applications for licenses to be advertised by the Federal Power Commission are those of the Ford Motor Company at Troy, N. Y., and of the State of Illinois for the use of the waters of the Des Plaines and Illinois Rivers.

Public Utility Securities to Become as Stable as Municipals

PUBLIC utility securities, because of the permanent public necessity for utility service and, in addition, because of the regulation which is consequently put upon the utilities, will eventually become in the nature of quasi-municipal securities, enjoying somewhat the same degree of stability as municipal issues themselves, was the statement of H. M. Addinsell of Harris, Forbes & Company, a member of the public utility committee of the Investment Bankers' Association, Wednesday night before the Association of Edison Illuminating Companies.

"We may just as well face frankly the fact," said Mr. Addinsell, "that the day of possible large speculative profit in public utility securities is passed.

"With the regulation that exists and the incontrovertible fact that these industries are an indispensable and permanent part of the economic structure of the communities they serve, they are becoming, and I think will become, increasingly of the nature of quasi-municipal securities. I look forward to the day when the public utility practice and financing will be so standardized and stabilized that the securities of these companies, at first in the larger communities and eventually everywhere, will command a market closely approximating—both as to level and real marketability—that enjoyed by the obligations of the municipalities themselves.

"I think that eventually some combination of the indeterminate permit and service-at-cost franchise will be universal. I perhaps should mention, however, that in view of recent experience, to be satisfactory, such franchises should contain no maximum rate and should provide a cushion in the form of a reserve fund to take up slack pending the readjustment of rates and thus insure continuously the companies the fair rate of return on their investment that is contemplated by such a franchise. So the broad solution lies in frankly putting the cards on the table and letting the light of publicity shine on the problems and purposes."

Utility Coal-Car Order Preference Expected to Be Continued

OWING to the absence of two of the members of the Interstate Commerce Commission, no conclusion as to the action to be taken on extending priority orders was expected to be reached before Friday of this week. It was very generally expected that the New England priority would not be extended, but G. W. Elliott of the National Committee on Gas and Electric Service, who is the point of contact between the public utilities and the Interstate Commerce Commission, was hopeful early in the week that assigned cars for public utilities would be continued. The committee is urging that the commission interpret "current use" as not less than twenty days' supply. Mr. Elliott made it clear that he is not interested one way or the other in the New England order, but he believes that assigned cars must be continued to insure daily supplies for public utilities.

New Jersey Utility Orders Own Cars to Insure Coal Supply

IN ORDER to insure a continuous supply of coal for its power plants the Public Service Electric Company of New Jersey has taken steps to overcome the disadvantages of a car shortage, so far as it is concerned, by providing its own coal cars. An order has been placed with the Standard Steel Car Company of New York for 600 all-steel coal cars with a carrying capacity of 55 tons each. Deliveries are promised for November, and the company expects to be carrying much of its contract coal from the Clearfield district of Pennsylvania in its own rolling stock before the end of the year.

"For those who have had to use large supplies of

coal," Thomas N. McCarter, president of the company, said, "conditions have been much worse during the greater part of the last year than at any time during the war, and as our electric company burns more than 3,000 tons of coal a day to supply light and power to domestic, commercial and industrial consumers in 191 municipalities, and to provide energy for the street cars, our problem has been a tremendous one.

"This time last year the company had a reserve coal supply of more than 200,000 tons; at present the reserve is less than 60,000 tons, due largely to a shortage of cars. There were days during the last six months when no cars were available for the company's contract coal and the only fuel it received was that bought in the open market. For weeks at a time the company failed to get normal shipments and was able to keep its plants going only by paying exorbitant prices for whatever coal it could buy. This 'free coal,' so called, cost double the contract figures, or more, but the company had to submit or run short of fuel. The purchase of the cars will, it is believed, prevent a repetition of such conditions.

"With the approval of the Interstate Commerce Commission, already granted, the cars will be used exclusively for the Public Service Electric Company, and they are of a capacity to handle three-fifths of the total supply required, provided that transportation conditions permit cars to make two round trips a month between the mines and the central stations. To handle the remaining two-fifths of its coal needs the company will depend upon cars regularly allotted under a priority order of the Interstate Commerce Commission."

Large Proportion of Assigned Cars Going to Utilities

DURING a hearing before the Interstate Commerce Commission on its wagon mine order J. B. Fisher, the general superintendent of transportation of the central region of the Pennsylvania system, selected a typical week for the territory under his jurisdiction to show the proportion of coal traffic moving under priority orders. During that week an average of 4,100 cars were loaded daily. Of that number 2,200 were assigned cars. He testified that more than 800 of the 2,200 were cars assigned for public utilities. The Great Lakes and tidewater took 900 cars, and there were 500 privately owned cars loaded.

Ohio Utilities Experience Better Coal Conditions

THE coal situation so far as Ohio utilities are concerned has materially improved. Coal shipments from the mines are increasing as a result of the coal-car preference order of the Interstate Commerce Commission. In fact, it is reported from a reliable source that mines are putting salesmen on the road soliciting orders from utilities in order to keep the mines running.

Prices for coal in Ohio are weakening, and there are some there who believe that if utilities and others refrain from storing coal at present prices for a while more nearly normal prices can be expected.

The car supply from the West Virginia fields is greatly improved owing, it is reported, both to the I. C. C. priority order and the quick unloading by utilities.

Nebraska Electric Utility Rates May Be Regulated by Commission

NEBRASKA electric utility rates are not now subject to commission regulation. Among the constitutional amendments that will be submitted to the voters on Sept. 21, 1920, at a special election is one that will make it possible for the Legislature to place every utility or common carrier under the jurisdiction of the Railway Commission, a thing that is not now possible.

Federal Power Commission Accepts Engineering Council's Offer

OFFICIALS of the Federal Power Commission have accepted the offer of the water conservation committee of Engineering Council to act in an advisory capacity on technical matters coming before the commission. At a conference between the two organizations on Sept. 10 various phases of the financial aspects of the regulations were discussed, and the committee of Engineering Council will prepare and submit recommendations thereon. O. C. Merrill, the executive secretary of the Federal Power Commission, expressed the belief that the committee will be very helpful to the power commission.

Poor Coal Causes Interruption of Service

ELECTRIC service in Rockford, Ill., was interrupted for brief periods throughout the morning of Sept. 9 owing to the inferior quality of the coal available at the power plant of the Rockford Electric Company. The interruptions began about 7 o'clock and continued until 11:15, when a better grade of fuel was obtained and normal service resumed.

In a statement to the local newspapers Adam Guchwindt, vice-president and general manager of the company, is reported as saying:

"The electric company is experiencing the greatest difficulty at the present time in obtaining the proper quality of coal for operation of the plant. We cannot buy it; it is sold to us. That is, we have to take any kind of fuel we can get without any selection as to quality on our part. The company's plant has sufficient capacity to produce the necessary amount of power, and there were no breakdowns today to warrant the curtailments in the flow of current. The whole trouble is in the poor grade of coal available for use."

Continued Coal Shortage and High Prices Predicted

OWING to the shortage of transportation, for which the solution can be worked out only gradually, public utilities may expect difficulty in obtaining their coal supplies for several years, asserted J. D. A. Morrow, vice-president of the National Coal Association, before the Pennsylvania Electric Association last week. This condition, together with increases in wages, freight rates and all other charges entering into its cost, will make cheap coal impossible in the future.

That the utility needs a preference in its coal supply in order to maintain service and prevent a public calamity was pointed out by Mr. Morrow. But because the utility is a preference customer it must pay a premium on the price of coal for the privilege.

Utility Commissions Should Recognize Efficiency, Says O. D. Young

WHILE state regulatory commissions maintain that they believe in the principle of rewarding efficiency in public utilities, they do not get right down to rock bottom by setting up formulas which will definitely show the companies and the consumers what both will gain in dollars and cents by increasing the efficiency of operation or the skill of management, or what will be the increased cost of service if the various demands of the consumers or the public are met. This was the opinion expressed this week by O. D. Young, vice-president of the General Electric Company, to a representative of the ELECTRICAL WORLD.

"It is not necessary for a commission to set up a formula that must be applied generally throughout the state," said Mr. Young, "or which is not to be altered when severe changes in general conditions come up. If, however, a basis of return which is fair at the time is definitely put down, together with the conditions under which increased economy will react on these returns, then commission regulation will be a servant instead of a master.

"A public utility has the right to know beforehand what proportion of a given increase in net revenue will remain as an increased return on the property value and how much of it will revert to the public. The public and the utility should be able to find out exactly what the increased cost of service will be if demands such as making line extensions or the placing of overhead distribution circuits underground are to be met without the insecurity of waiting for the commission to decide at the time according to its judgment or political expediency."

Many Technical and Commercial Topics Discussed by New England Men

FOUR hundred delegates registered at the twelfth annual convention of the New England Geographic Division of the National Electric Light Association at Mount Kineo, Me., on Tuesday. The sessions were enthusiastic and a splendid response to the new organization development of the parent body was evident. The features of Tuesday's meeting were a stimulating and informing address by W. S. Murray on the progress of the super-power zone survey, an able outline of national association work by Executive Manager Aylesworth and a fine technical session planned by I. E. Moultrop and conducted by W. H. Cole, E. B. Ricketts, W. K. Vanderpoel and D. S. Boyden. Great interest was taken in the discussion of the technical reports made at the Pasadena convention of the N. E. L. A.

An emphatic telegram urging the Interstate Commerce Commission to extend priority order No. 9 was sent.

The intensive use of paper-insulated cable was favored in the technical session discussions, as well as the use of motor-driven auxiliaries supplied from the house turbine to secure a heat balance. A record of 8.6 kw. per boiler-horsepower was obtained at a recent Boston Edison company test where equipment was forced beyond desirable operating conditions. The automatic station is coming into larger use for all classes of service. Speakers urged the need of specification for farm-line construction.

At the public policy session on Wednesday night addresses were made by M. R. Bump, W. E. Stanwood of Boston and M. H. Aylesworth.

Problems of Large Systems Discussed by Edison Association

ABOUT 150 executives and engineers of the central-station companies operating in the metropolitan centers of the East and Middle West attended the thirty-ninth convention of the Association of Edison Illuminating Companies at New London, Conn., Monday to Thursday of this week. President Walter H. Johnson of Philadelphia at the opening session briefly commented on the work of committees during the year, calling attention to the creation of the new committee on steam turbines and generators. That committee, headed by H. P. Liveridge of Philadelphia, and the committee on troubles in generation on direct-current distribution systems, headed by Philip Torchio of New York, presented very comprehensive reports covering all phases of large-system operation. Through co-operation between the operators and manufacturers it was pointed out that certain changes have been brought about which are expected to prevent the troubles that have been experienced with large turbine units.

In the symposium of the committee on troubles in generating stations and distribution systems details of special disturbances were outlined and their effects on operation. Those special troubles included short circuits, cable failures, control failures and the like. These troubles were largely caused by the strain on all systems due to the growth of load and abnormal operating conditions. It was pointed out that reliability of control circuits through special storage-battery installation, the proper use of reactors to maintain stable synchronizing conditions where several units are operated together in separate stations and to protect switches and circuit breakers by limiting momentary short circuit currents are among the operating problems of first importance.

Dr. C. P. Steinmetz in a very interesting paper took up the problem of synchronous operation arising from the use of power-limiting reactors, discussing them from the standpoints of reliability and economy. Another particularly interesting paper was presented by E. W. Rice, Jr., president of the General Electric Company, on turbine characteristics, in which he reviewed briefly the troubles experienced during the war period with large turbines and the research methods that have been employed to determine the causes and apply corrections. By lantern-slide illustrations he showed the studies which have been conducted to detect flaws in metals and character of vibrations that are liable to occur.

Commercial problems were discussed, with particular attention to power factor, rates, special loads such as electric welding and electric furnaces, and the financing of future requirements in plants and lines. A feature of this convention was the discussions by those who have been associated with the electrical industry since its early days. Among these were Alex Dow, Detroit Edison Company; John W. Lieb, New York Edison Company; L. A. Ferguson, Commonwealth Edison Company; Dr. C. P. Steinmetz, General Electric Company; Dr. A. E. Kennelly, Harvard University and Massachusetts Institute of Technology; S. F. Mitchell, Electric Bond & Share Company; C. L. Edgar, Edison Electric Illuminating Company of Boston, and E. W. Rice.

Northwest Utility Men Discuss Technical Problems

ABROAD general survey of the technical problems of the Northwest was taken at the second session of the Spokane convention of the Northwest Electric Light & Power Association. This was the first year of the Technical Section, and a most comprehensive report was presented by George E. Quinan, Puget Sound Power & Light Company, chairman. That particular attention be given to the education of meter readers was urged in the discussion of the meter report, presented by J. C. Henkle, Portland Railway, Light & Power Company, as well as the necessity for all members of a company understanding and conveying to the public the idea of the accuracy of meters. H. J. Gille, Puget Sound Power & Light Company, appealed for further study of power-factor recording devices, which are now becoming an important Western problem. Survey of Western practice in the use of hydro-electric apparatus was made in the apparatus report by F. D. Nims, Washington Coast Utilities Company, who pointed out the responsibility of the West in hydraulic research.

The need for a special study of the oil-switch problem was brought out in the discussion, as Western plants will soon reach the limit of rupturing capacity of switches now manufactured. That attention should also be given to non-electrical apparatus and performance records kept for the guidance of manufacturers was brought out by S. C. Lindsay, Puget Sound Power & Light Company. Steam prime movers, being more especially an Eastern problem, were not emphasized in the report. The acuteness of the inductive interference problem was outlined by Mr. Quinan, who cited many requests for aid in interference cases and sketched the general principles as outlined by the national committee as important. The co-operation of the communication interests in the scientific study of this problem was pledged by D. I. Cone, Pacific Telephone & Telegraph Company, who urged a joint consideration of the difficulties before construction rather than an adjustment afterward. A paper on pole treatment was presented by W. M. Leavitt, Western Red Cedar Association, who told of the success of the new puncturing treatment which guarantees half-inch penetration even with unseasoned wood.

F. T. Griffith, Portland Railway, Light & Power Company, presented a survey of N. E. L. A. work in its relation to Western needs and urged concerted action in carrying out a national public policy program of education. The importance of protecting poles from fires was brought out in the discussion of the report on overhead construction presented by R. M. Boykin, North Coast Power Company.

Active discussion brought out by the range report reflected the extreme interest in this subject in the Northwest. It was apparent that, although the range business had been allowed to lapse somewhat, owing to high construction costs, it was in a healthy state at present and on the way to large increases. Transformer and installation costs had not proved so much of a burden as had been anticipated, and also the diversity factor of this load was more attractive than had been expected. The use of a two-way switch between a water heater and a range was supported by the experience of several companies. W. R. Putnam, Idaho Power Company, concluded the discussion by pointing out the justification for an increase in cooking rates to meet increases in cost of other fuel.

W. M. Hamilton, Portland Railway, Light & Power Company, concluded the meeting with an able analysis of management problems, which he held might be summed up as the necessity for maintaining cordial relations between employer and employed and company and public.

The election of officers resulted in the choice of Franklin T. Griffith, Portland Railway, Light & Power Company, as president; R. M. Boykin, North Coast Power Company, Portland, member of the executive committee at large, and the following vice-presidents: Montana—O. W. McConnell, Helena; Idaho—W. R. Putnam, Boise; Utah—S. R. Inch, Salt Lake City; Oregon—George L. Myers, Portland; Washington—N. W. Brockett, Seattle.

Telephone and Telegraph Lines to Operate on Poles Carrying Over 5,000 Volts

DRAWING up and executing a contract for the use by telephone and telegraph companies and electric power companies of joint-pole lines where the transmission voltage is above 5,000 volts was the principal feature of the report of the engineering committee, Paul Spencer chairman, at the convention of the Pennsylvania Electric Association at Bedford Springs, Pa., Sept. 8 to 11. This contract, which is the result of nearly a year's negotiations between the engineering committee and representatives of the telephone and telegraph company, provides that where it cannot be reasonably avoided circuits above 5,000 volts may be put on a joint-pole line.

In an address on "Coal Storage" O. P. Hood, chief mechanical engineer, United States Bureau of Mines, pointed out that one of the troubles causing spontaneous combustion has been that undue attention has been given to minor factors such as sulphur, height of pile, volatile matter, etc., while the main factors, such as initial temperature, breakage in handling, freshness of coal and coal screening before storage have been overlooked.

In a paper on "Power Service—Where Do We Go from Here?" G. M. Gadsby called attention to the rapid development of new fields for electric service.

As the result of the large sales of household energy-consuming devices a greatly increased residential load has been built up and some central stations estimate that 50 per cent of their total residence load is due directly to this source, said Thomas W. Berger in a paper discussing electrical merchandising.

Data were presented by Joseph McKinley in a paper discussing the advantage of purchased power, showing the increasing use of central-station power by manufacturers who have found it more profitable to invest their money in expansion of their business rather than in non-productive isolated power plants.

Determination of the capacity and location of pole-line distributing transformers with reference to the investment required and efficiency of operation was discussed in a paper on the economical arrangement of pole-line transformers of George S. Humphrey.

At the close of the convention the following officers were elected for the ensuing year: President, Henry Harris, Wilmerding, Pa.; first vice-president, A. H. S. Cantlin; second vice-president, E. H. Davis, Williamsport, Pa.; treasurer, H. H. Ganser, Norristown, Pa.; secretary, Henry M. Stine, Harrisburg, Pa.

Public Must Be Educated if Suspicion Is to Be Dispelled

THE public cannot shift the burden of increased costs in such a way as to bring financial distress to the utilities, declared Thorne A. Brown of the Nebraska Railroad Commission in his address before the Nebraska Section of the National Electric Light Association at Omaha on Thursday, Sept. 9. The utilities are facing an unfavorable past history that has aroused suspicion in the public mind, and it is entirely up to them to dispel this suspicion by careful and tactful education, Mr. Brown added. The utilities cannot expect a fair-minded attitude on the part of the public unless a fair-minded attitude toward the public is maintained, it was argued. The address also pointed out the impossibility of municipalities properly handling regulatory problems because of a lack of facilities and organization and the pressure of purely local business and political conditions. Regulatory bodies reflect the public attitude, and while utilities are legally protected as to earnings, regulatory bodies have in many cases been responsible for improper rates due to excess caution because of public suspicion and political conditions.

The merchandising problem is being studied from the engineering standpoint, according to H. D. Sanborn, who led in the discussion of T. E. Roach's paper on "Central-Station Merchandising."

F. H. Brooks presented a clear outline of present rural-line distribution financing practices, the Wisconsin and Iowa methods being largely dealt with. R. J. Andrus, A. J. Cole and J. C. Martin discussed the paper, pointing out mistakes made in financing and rates due to insufficient consideration of the problem as to its probable development.

The discussion on "Public Relations in Nebraska" Wednesday evening was participated in by W. B. Roberts, Horace M. Davis and Frank Mays. The necessity of getting a thorough understanding of utility matters before the public and city councils was discussed by all the speakers. The activities of the Nebraska Committee on Public Utility Information were described by Mr. Davis. President Martin J. Insull of the National Electric Light Association told of the new activities of that body and urged the importance of commission regulation. The Nebraska commission has no jurisdiction over electric utility rates.

The following officers were elected: President, James B. Harvey, Omaha; vice-president, W. B. Boberts, Omaha; executive committee, J. E. Harsh of Lincoln, W. B. Roberts of Omaha, O. J. Shaw of Lincoln, C. H. Cornell of Valentine, J. E. Davidson of Omaha, and J. B. Harvey of Omaha.

DELEGATES TO THE NEBRASKA N. E. L. A. SECTION CONVENTION GROUPED IN FRONT OF HOTEL FONTENELLE, OMAHA

West Wants 1921 A. I. E. E. Convention at Salt Lake City

WESTERN members of the American Institute of Electrical Engineers are anxious to secure the 1921 annual convention at Salt Lake City in conjunction with the annual Pacific Coast convention. F. L. Hutchinson, secretary of the Institute, who has just returned from an extensive tour of the West, reports that, since the Portland convention, at which a resolution to the above effect was adopted, from conversation had with members the plan seems to have the general approval of the Far West. It is also known that influential members further east are in sympathy with the proposal. Except for the Milwaukee convention in 1906 and the San Francisco convention in 1915 no annual convention of the Institute has been held in the West since 1898, when it was held at Omaha.

Society for Electrical Development Launching Christmas Campaign

THE Society for Electrical Development is launching its annual electrical Christmas campaign. The outstanding feature of the dealer helps to be supplied during this year's drive will be an attractive eight-color window display cutout featuring the slogan, "Say 'Merry Christmas' electrically." Poster stamps, attractively printed letters, advertising cuts and other selling helps will be supplied. Full particulars of the drive will be mailed to the industry about the middle of October. The plans were laid before the executive committee at its Sept. 10 meeting and were approved.

Many Public Utility Hazards to Be Considered by National Safety Council

MEETING at Milwaukee, Wis., from Sept. 27 to Oct. 1, the National Safety Council will have a five-day program packed full of reports and papers bearing on the avoidance of industrial accidents. The program for the meetings of the public utilities section, two in number, is as follows:

TUESDAY, SEPT. 28

Reports. Addresses: "Hazards in Line Construction—Handling Poles, Erecting Poles, and Reconstruction of Old and Antiquated Lines," by F. W. Fisher, Rochester (N. Y.) Railway & Light Company; "Accident Hazards in Laying Conduit Underground," by H. W. Lueck, Commonwealth Edison Company, Chicago; "Accident Hazards in Laying Gas Mains," by R. S. Carter, Malden, Melrose Gas Light Company, Malden, Mass.; "Utility Accidents to the Public Prevented Through School Safety Education," by Dr. E. George Payne, principal Harris Teachers' College, St. Louis.

WEDNESDAY, SEPT. 29

Report of nominating committee. Addresses: "Medical Service in Public Utilities," by Dr. C. H. Lemon, Milwaukee Electric Light & Railway Company; "Hazards in Building Additions to Power Plants—Protecting Operators and Equipment," by W. H. Mulligan, Hydro-Electric Power Commission of Ontario; "Accidents to Meter Readers and Other Employees on Equipment Outside of the Company's Premises," by George Opp, Detroit Edison Company, and F. A. Tewksbury, Denver Gas & Electric Light Company; "Fixing the Responsibility and Penalizing Those Responsible for Accidents and Awarding Those Showing Meritorious Action in Time of Accident," by H. C. Lucas, Philadelphia Electric Company.

On Tuesday, Sept. 28, there will be a "get-together" luncheon of the public utilities section, with addresses by A. W. Berresford, president of the American Institute of Electrical Engineers, and Martin J. Insull, president of the National Electric Light Association.

Sliding Scale of Bonus and Forfeiture Advocated at Indiana Convention

THE keynote of the twelfth annual convention of the Indiana Electric Light Association, held at French Lick Springs this week, was struck by President P. H. Palmer when he said in his opening address: "The utilities of the state are kept alive by the allowable fixed rate of return, but this creates no incentive for better service and more efficient operation. The public and the investors will both be better off when public utilities are operated on a sliding scale of bonus and forfeiture in proportion with the increase or decrease in efficiency.

Martin J. Insull, president of the National Electric Light Association, and E. I. Lewis, chairman of the Public Service Commission of Indiana, were on the program for the first day, but neither could be present.

The contention of many central-station managers that no unavoidable investment should be made until prices drop was declared to be untenable in an address by G. S. Neal of Michigan City. He said that any improvement should be made if it reduced annual operating expenses by one-third of its cost.

"I do not believe that in the whole State of Indiana there is a single public utility operating today that is earning or has been allowed to earn by the commission what the laws of the State of Indiana says that the commission should allow it to earn," said Charles C. Perry, president of the Indianapolis Light & Heat Company, in an address on "The Public and Public Utilities." "Every public utility of whatsoever character should help to educate the people with reference to the provisions of the public utility law." This paper brought out an extended discussion led by Harry Reid of Louisville, Ky., on central-station credit, financial and public policy matters.

The report of the last two days of the convention will appear in an early issue.

Finance and Regulation Main Topics at Colorado Convention

THE Colorado Electric Light, Power and Railway Association met in its seventeenth annual convention at Glenwood Springs, Col., on Monday, Tuesday and Wednesday of this week, joining with the Rocky Mountain Geographic Division of the National Electric Light Association, which held its first convention at this time.

A. C. Foster, president of the Bankers' Trust Company, Denver, spoke optimistically of the future of utility securities, which, while at present difficult to sell, are being taken up more freely than heretofore. Norman Read, Colorado Power Company, and president of the association, made the feature of his address the lack of understanding of the problems of the utilities by the general public and the necessity of an educational campaign to foster a spirit of respect for the utilities and the commissions which will make the marketing of their securities easier and lead to a better public appreciation of the service.

Mr. Dwight, engineer of the Public Utilities Commission of Colorado, pleaded for a better understanding between the utilities and the commissions. His point was that the commissions now have a better appreciation born of knowledge of the public utility business, but that there are forces at work to bring regulation to naught. In combating these forces it is necessary for the utilities and the commissions to work together for the common good.

The necessity of uniformity in power contracts throughout the state was emphasized by T. O. Kennedy of the Denver Gas & Electric Light Company. There appears to be a wide divergence of practice in charging for extensions and in apportioning the costs among the various users of the lines.

A feature of the convention was the address of Martin Insull, president of the National Electric Light Association, who dwelt on the newer and broader activities at the headquarters of the association.

W. H. Onken, Jr., editor of the ELECTRICAL WORLD, discussed regulation from a public policy viewpoint and the obligations that utilities are under, not only rendering maximum service but also in working in close cooperation with public service commissions. He elaborated on a higher phase of municipal ownership through customer ownership of securities and told why preferred stocks and bonds were being taken rather than common stock. The advantages of large scale production were discussed and the disadvantages under which water-power companies are laboring financially was touched on.

Officers were elected as follows: President, C. A. Semrad, Boulder, general manager Western Light & Power Company; first vice-president, T. O. Kennedy, Denver, general superintendent Denver Gas & Electric Light Company; second vice-president, F. Norcross Greeley.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Newton, Iowa, Sells Light Plant.—At a special election held recently the voters of Newton, Iowa, indorsed by more than two to one a proposition to sell the city's electric light plant for $41,500 and granted a franchise to A. H. Rich of Des Moines.

Exposition of Chemical Industries.—The sixth National Exposition of Chemical Industries will be held in the Grand Central Palace, New York City, in the week beginning next Monday, Sept. 20. Among many motion pictures showing progress in the chemical art will be two series illustrating the United States ammonium nitrate plant No. 2 at Muscle Shoals, Ala.

Naval Radio Service Now Accepts Private Messages.—The United States Navy Department is now accepting private and press radio messages to France, which are transmitted by way of the big power radio station at Lyons. Commercial messages to Colombia, Ecuador and Venezuela are sent through the radio station at Porto Colombia. The navy will also accept messages to Belgium and the Netherlands, Italy, Luxemburg, Switzerland, Czechoslovakia and Jugoslavia.

Western Electric Employees Buy Bonds.—Among the subscribers to the recent issue of five-year 7 per cent convertible gold bonds issued by the Western Electric Company were 4,574 employees, representing investors in each of the forty-two branches of the concern. They have applied for securities aggregating approximately $2,000,000 par value. The sale to the employees was made under an installment basis, payment being made on a schedule similar to that used during the Liberty Loan drives.

Achievements of Naval Consulting Board.—Many of the most interesting inventions of the war are set forth, with illustrations, in "The Naval Consulting Board of the United States," a book just issued under the auspices of the Navy Department. The work of Thomas A. Edison, who is president of the board, is described, and the development of the listening devices employed successfully in the war for the detection of submarines is recounted in detail. Lloyd N. Scott is the author of the volume, of which a sales edition will be issued by the Government Printing Office should the demand for copies warrant it.

Electrification of Italian Railroads.—The general plan for the electrification of the railroads of Italy drawn up by the government includes four groups of roads. The first of these groups, which is to be electrified at once by the Administration of the Railways, has a total length of 826 miles; the second group, also to be electrified by the administration but at a later date, has 695 miles; the third group, on which experiments with new systems of traction are to be made, has 157 miles, and the fourth group, to be left to private enterprise, has 1,080 miles. The new systems of traction which are to be experimentally installed are described as including a three-phase system with industrial frequency, a system of direct current at high tension, and a system of direct current with ordinary voltage and accumulation.

Hydro-Electric Project at the Falls of the Ohio.—The utilization of waste water power at the Falls of the Ohio, Louisville, Ky., has been recommended in an official report to General Lansing H. Beach, Chief of Engineers, U. S. A. Hitherto it has been thought that the low stage of these rapids for two months of the year, necessitating a supplementary steam plant, rendered their development uneconomical; but the increased price of coal has operated to change this opinion. It is reported that 100,000 hp. could be developed with an outlay of $9,500,000, and that from 20,000 hp. to 50,000 hp. could be produced very cheaply. It is also contended that by the construction of a canal connecting the two branches of the U-shaped river and affording a 24-ft. drop in a distance of two or three miles the difficulty caused by the varying stages of the stream would be eliminated.

Increased Rates for Electricity in Many Sections.—The City Council of Springfield, Ill., has abolished the discount of 10 per cent formerly allowed on electric light bills paid before the tenth of the month, this amounting to an increase of 12.2 per cent for energy furnished by the municipal plant. The Minneapolis General Electric Company has imposed a surcharge of 10 per cent on all bills for electric lighting and power as a coal emergency measure. The Public Service Commission of Oregon has permitted the Bandon Power Company to raise its rates, the former ones being found non-compensatory. In Lenoir, N. C., the Corporation Commission has allowed the Citizens' Light & Power Company a temporary increase in rates. Twenty per cent has been added to the rates of the Dublin (Ga.) municipal plant and 60 per cent to those of the Kentucky Light & Power Company at Hickman, Ky. Martin's Ferry, Ohio, has raised the price of energy furnished by the municipal plant. The Clinton (Mass.) Gas Light Company has put up its electric rates 1 cent a kilowatt-hour, and the Cambridge (Mass.) Electric Light Company has adopted a fuel charge of 1¼ mills per kilowatt-hour for each dollar's cost per ton of coal in excess of $5, no charge for electricity, however, to exceed 9 cents per kilowatt-hour. In Arizona the Deseret Power & Water Company, operating in Mohave County, has been permitted by the Corporation Commission to advance its rates.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Power Club Convention at Hot Springs, Va.—The convention of the Electric Power Club will be held at the Homestead Hotel, Hot Springs, Va., Nov. 15-18, 1920.

E. S. J. A., Atlantic Division.—The next regular quarterly meeting of the Atlantic Division of the Electric Supply Jobbers' Association will be held Sept. 23 at the Bellevue-Stratford, Philadelphia.

Duluth Engineers' Club.—Graham Bright, general engineer of the Westinghouse Electric & Manufacturing Company, will give talks on "Electric Mine Equipment" before the Duluth (Minn.) Engineers' Club and the Engineers' Club of Northern Minnesota at Virginia, Minn., on Sept. 20 and 25, respectively.

Montana State Contractor-Dealer Association.—The second convention of this association was held recently at Great Falls, the organizing convention having been held at Butte only last April. A movement is under way to affiliate with the National Association of Electrical Contractors and Dealers. The jobbers and the central-station men of Montana have become affiliated with the Contractor-Dealer Association, and a co-operative campaign on the lines followed in California is being planned. The president of the Montana body is J. P. Currah of Helena, and the secretary is E. Downing of Butte.

Coming Meetings of Electrical and Other Technical Societies

Association of Iron and Steel Electrical Engineers—New York City, Sept. 20-24. (For program see issue of Sept. 4, page 492.)

Atlantic Division, Electrical Supply Jobbers' Association — Philadelphia, Pa., Sept. 23.

Central Division, Electrical Supply Jobbers' Association—Chicago, Sept. 24.

American Electrochemical Society—Cleveland, Sept. 30-Oct. 2.

Illuminating Engineering Society—Cleveland, Oct. 4-7. (For program see issue of Aug. 14, page 349.)

National Association of Electrical Contractors and Dealers—Baltimore, Oct. 4-9. (For program see issue of July 24, page 205.)

Electric Furnace Association — Columbus, Ohio, Oct. 6.

American Electric Railway Association—Atlantic City, N. J., Oct. 11-15.

National Association of Electrical Inspectors—Philadelphia, Pa., Oct. 12-13.

British Columbia Association of Electrical Contractors and Dealers—Vancouver, B. C., Oct. 19.

International Association of Municipal Electricians—New Orleans, Oct. 19-22.

Association of Railway Electrical Engineers—Chicago, Oct. 28-31.

Electric Power Club—Hot Springs, Va., Nov. 15-18.

Southeastern Geographic Division, N. E. L. A.—Miami, Fla., Nov. 17-19.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

What Constitutes Negligence.—The St. Louis (Mo.) Court of Appeals in a suit for damages (Gilbert vs. Hilliard) has declared that "negligence" is properly defined in an instruction to the jury as failure to use ordinary care, which is the care that reasonably prudent men would use under the same and similar circumstances. (222 S. W. 1027.)*

Unjust Rates Cannot Be Approved by Commission.—In Borough of Greensburg vs. Public Service Commission of Pennsylvania, the Supreme Court of Pennsylvania asserted that the commission was unable to order or approve the collection of rates which it had found to be unjust and unreasonable. (110 At. 750.)*

City Estopped from Denying that Rights Were Conferred on Company.—Where a city has charged a power company yearly sums, designated as rent, for granting the right to lay and operate its conduits on a bridge, it is precluded from taking the position that the power company already had the right to cross the bridge under its general franchises and powers, and that therefore no rights were conferred or consideration given for the payments which were exacted, according to a decision of the Court of Appeals of New York in a proceeding by the New York & Queens Electric Light & Power Company against the Public Service Commission to have such sums credited on assessments made on special franchises granted to the company. (128 N. E. 131.)

Negligence Under California Workmen's Compensation Act.—The failure of a master to comply with a general safety order of the Industrial Accident Commission of which he had no notice would not of itself constitute "gross negligence" within the meaning of the workmen's compensation, insurance and safety act of California, according to a decision of the District Court of Appeals of that state in Schmidt vs. Pursell. It is incumbent upon a servant suing for personal injuries caused by gross negligence to prove that injury resulted both from gross negligence and from willful disregard of life, limb or bodily safety, the term "to willfully disregard" meaning to intentionally do or fail to do something which contributes to the injury, having actual knowledge of the perils incident thereto or having what in law is equivalent to such actual knowledge. (190 Pac. 846.)

Moral Debt by Company Where Excessive Rates Have Been Paid.—If a consumer, pending a decision by the Public Service Commission, pays to a public service company sums which are subsequently found to be excessive, such excess payments are, according to a judgment of the Pennsylvania Supreme Court in Borough of Greensburg vs. Public Service Commission of Pennsylvania, debts morally due by the company, even though the statute of limitations prevents a recovery by suit; and it may recognize and pay them at any time. Customers of a public service company are, however, legally interested only in being charged nothing beyond just and reasonable rates, and hence if this is secured to them they have no just ground of complaint. (110 At. 750.)

Burden of Proof.—Where complaint is filed against a schedule of rates of a public utility within the thirty days before schedule becomes effective under the public service act, the burden of proving the rates reasonable, the Pennsylvania Supreme Court has declared, in Suburban Water Company vs. Borough of Oakmont, is on the utility; but if complaint is made after the schedule becomes effective the burden is on the complainant. (110 At. 778.)

Rehearing from Commission Need Not Be Asked Before Court Action.—The Supreme Court of Indiana has determined, in Greensburg Water Company vs. Public Service Commission, that as the public utilities commission act contains no provision requiring a party dissatisfied to apply first for a rehearing by the commission one dissatisfied with a commission order need not make such application. The act limits the time for bringing an action in the courts to sixty days after the decision or thirty days after an order of the commission has been set aside. (128 N. E. 103.)

Death from 120 Volts Held Not to Warrant Damages — Negligence Must Be Proximate to Be Actionable.—Two points of interest were decided by the Supreme Court of Alabama in Lawson vs. Mobile Electric Company. In this case damages were sought because of the death of a negro ship worker who while standing on a wet plank received an electric shock through an imperfectly insulated lamp cord. It was held to be clearly proved that the voltage could not have exceeded 120, and the court held that, this not being a fatal voltage, the doctrine of *res ipsa loquitur* (the thing speaks for itself) did not apply. The company was charged with negligence in failing properly to inspect its transformers, but the court held that this would not justify recovery for the death of the man, since an examination after the accident showed that in this instance the transformer was working properly and no excessive current was carried. Negligence, it held, must be proximate to be actionable. (85 So. 257.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Basis of Valuation on War Values Denied.—In the Chesapeake & Potomac Telephone Company rate increase case the Virginia Corporation Commission held that a fair and reasonable basis for valuation is the reproduction value as of normal times at pre-war prices, plus the actual sums necessarily expended during the period of inflation less depreciation deductions.

Heating Plants of Electric Utilities.—In denying an application from the Southern Illinois Light & Power Company to discontinue in part its heating service, the Illinois Public Utilities Commission, while asserting that a heating plant receiving its heat for the most part from the exhaust steam of an electric plant should not be required to extend its lines beyond a reasonable distance from the plant or into the residential districts where the amount of business served per unit of distribution main is relatively small, declared that a utility furnishing such heat could not be permitted to serve a portion of its consumers and abandon others which it had taken on while operating under a franchise obtained from the city government.

Definition of "Demand Charge."—The Idaho Public Utilities Commission, in fixing the amount of demand charge to be made to a certain irrigation district by the Idaho Power Company, said: "Demand charge is simply a readiness-to-serve charge. In other words, it is an amount paid to the power company by the customer for the privilege of having a certain portion of the company's capacity reserved for the use of the particular customer whenever he may call for it. Whether he calls for the service or not, the demand charge must be paid because the service is held for him. However, a readiness to serve means an ability to serve. The customer pays for, and the company must receive its payment through, service rendered. When a utility holds part of its capacity for the service of a company it performs a very real service for which it is entitled to payment; but this service is of full value only when the energy to meet the customer's full demand is available when made." The commission went on to assert that the demand charge of an electric company should not reflect an amount of horsepower greater than the company is able to deliver with a reasonable degree of certainty and continuity when the demand for this service is made by the consumer.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Franklin T. Griffith, president of the Portland Railway, Light & Power Company, who was elected president of the Northwest Electric Light & Power Association at the Spokane convention on Sept. 9, 1920, is a native of Minnesota, where he received his early education in the Oakland Academy. In 1894 he was admitted to the bar in Oregon, and he was for a number of years connected with the legal department of the Portland General Electric Company. He has been employed by the Portland Railway, Light & Power Company since 1904 and early in 1913

F. T. GRIFFITH

was elected vice-president. On July 1, 1913, he succeeded B. F. Josselyn as president. Mr. Griffith was chairman of the water-power development committee of the National Electric Light Association during the year 1919-1920 and has been re-elected for the year 1920-1921. At the Pasadena convention in May, 1920, he was elected fourth vice-president of that association.

Obituary

Dr. Samuel Sheldon, who for the last thirty-one years had been professor of physics and electrical engineering at the Polytechnic Institute of Brooklyn, died Sept. 5 at Middlebury, Vt., while on his vacation. As an experimental physicist, electrical engineer, scientific writer and author Dr. Sheldon was well known in this and other countries. As professor of physics and electrical engineering at the Polytechnic Institute Dr. Sheldon organized the latter department and under his supervision the mechanical engineering, physical and electrical engineering laboratories were installed. During his administration he also carried on an extensive consulting engineering practice. His reports of experimental investigations to the Electro-Therapeutic Association constitute a valuable contribution to science and to the art relating to electrostatic machines. Dr. Sheldon was born at Middlebury, Vt., fifty-eight years ago. He was graduated in 1883 from Middlebury College with the degree of A.B. and remained there two years as instructor in mathematics. In 1887 he received the degree of A.M. In the fall of 1885 he entered the University of Würzburg, Germany. During his first year there he was selected by Professor Kohlrausch to assist in special investigations, among which was the classic determination of the ohm for the Bavarian government. At that time he held the position of assistant in laboratory physics. He was graduated in 1888 with the degree of doctor of philosophy. He then returned to America and was appointed first assistant in physics under Prof. John Trowbridge at Harvard University, where he conducted many original investigations in magnetism, the results of which were embodied in papers presented before the American Academy of Arts and Sciences. In 1899 Dr. Sheldon was appointed to the chair of physics and electrical engineering at the Polytechnic Institute of Brooklyn. Dr. Sheldon was a member of many engineering organizations, including the American Institute of Electrical Engineers, American Association for the Advancement of Science, Brooklyn

SAMUEL SHELDON

Institute of Arts and Sciences, American Electro-Therapeutic Association, New York Electrical Society, American Physical Society, Society for the Promotion of Engineering Education, American Electrochemical Society and the American Electric Railway Association. Professor Sheldon was the author of the following technical books: "Dynamo-Electric Machinery," "Alternating-Current Machines," "Electric Traction and Transmission Engineering" and "Physics Laboratory Experiments."

Prof. John Perry, well-known scientist and engineer, who died at his home in London on Aug. 4 at the age of seventy, was widely known as an inventor, teacher and author. Among the books published by him are "The Calculus for Engineers," "Applied Mechanics" and "Steam, Gas and Oil Engines." Many of his lectures and addresses before the British engineering societies and technical colleges have been published in book or pamphlet

JOHN PERRY

form. Many honorary degrees were conferred upon him, and he was a past-president of the Institution of Electrical Engineers and of the Physical Society and treasurer of the British Association. In conjunction with Professor Ayrton, he brought out many inventions, including multipolar dynamos in 1882. These two men were also pioneers in electrical instrument development, and credit is accorded to them for having invented the first motor meter put on the market in Great Britain. Professor Perry had a long career as a teacher, beginning in 1870 at Clifton and later being honorary assistant to Sir William Thomson (Lord Kelvin) in Glasgow. He was joint professor of engineering with Professor Ayrton from 1875 to 1879 at the Imperial College of Engineering in Japan. In 1882 he became instructor in mechanical engineering and applied mechanics at Finsbury Technical College and later was made professor of mechanics and mathematics at the Royal College of Science in 1896, retaining that post until 1913, when he was retired under the age-limit rule. Upon his retirement from the Royal College of Science in 1913 he was chosen by the government to investigate the conditions of education in South Africa, and he was largely instrumental in drawing up a scheme for the foundation of the South African University. During the last few years he gave scientific advice on military matters and pursued studies in gyroscopic temperatures.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

South African Dealers Complain of American Manufacturers

DEALERS in American electrical goods in South Africa are complaining because they are unable to get long-standing orders filled in the United States, the American Trade Commissioner at Johannesburg reports. Some of these customers say that they have had goods on order for twelve months and still have no definite promise of delivery.

Lack of consideration for foreign customers is one of the old standing complaints against American methods. It has been "harped" on time and again. The South African dealers seem to be of the opinion that American manufacturers are devoting all of their attention to the domestic market and that they have tied up their output for long periods without giving a thought to agents and customers thousands of miles away who may be entirely out of goods.

Dr. R. S. MacElwee, Director of the United States Bureau of Foreign and Domestic Commerce, urges manufacturers of electrical goods to make a special effort to fill foreign orders: "If they do not," said the director, "much harm will result to American business, not only in the electrical trade but to other lines as well. Indifference to the needs of foreign customers in one line of goods readily affects the sale of other American products in the same section. I do not believe our manufacturers are willfully neglecting their foreign patrons. Some of them simply do not appreciate the importance of the subject and do not seem to realize the national harm which may result."

American manufacturers will soon have to face keen competition in foreign markets. It is not likely that our competitors will overlook "American indifference" as a selling argument, especially if they find foreign business men in a receptive mood for such propaganda. To eliminate legitimate cause for complaint and keep the factories going is the director's final advice.

Decided Improvement Seen in the Labor Situation

A SURVEY of labor conditions throughout the country reveals marked improvement in the situation. A greater supply of available workmen, less labor trouble, fewer strikes, and in many cases an improvement in the unit efficiency of labor, are the features which mark the situation.

While no material reduction in the amount of labor employed by the electrical industry is noticed, except where the inefficient workman has been released, still the release of labor by other industries makes it less difficult for the electrical manufacturer to keep a full force together. It also acts as a stabilizer to labor by discouraging to a degree job-changing and strikes on the slightest provocation. An analysis of the labor situation from this angle therefore is interesting.

The gradual development of non-employment in many parts of the country has apparently been caused by three factors. Delays in receiving fuel and raw material have compelled plants to curtail operation. In other districts canceling of orders and lack of demand have caused the shutting down of factories. In the third place, inability to obtain needed capital has quite often resulted in the abandonment or suspension of contemplated undertakings. The results of this non-employment, it is reported, have been an increase in the efficiency of the individual and less insistent demands on the part of labor.

In a recent report of the United States Department of Labor in which employment statistics were presented for thirteen manufacturing industries and for coal mining the figures for July, 1920, when compared with the previous month, show a decrease of about 6 per cent in the number of workers employed and a decrease of about 11 per cent in the amount of the total payroll.

In the New York district there has been a distinct though not large increase in non-employment. The report of the New York State Industrial Commission shows that the decrease in the number of factory workers employed in July over June in the State was one-half of 1 per cent. General labor conditions in that section are more stable than a few months ago.

Better Conditions in New England

Labor conditions in the New England electrical industry are improving materially. While in some establishments unrest continues to interfere with production, a decided turn for the better is apparent. There is little question that recent shutdowns in the textile and leather fields have had a sobering effect upon employees in other industries. This has begun to temper the attitude of many workers toward their daily duties, and consequently an increase in production per employee is to be found in many branches of the electrical manufacturing industry.

Inquiry by a representative of the Electrical World among representative electrical manufacturing plants develops the conclusion that the employer is beginning to come into his own once more. In two-thirds of the establishments with which the Electrical World is in touch new employees are still being hired, but applications for employment are increasing in 80 per cent of the plants. In about 60 per cent of the plants orders are either holding up as well as during the spring or increasing, and in 87.5 per cent of the establishments labor is producing better. Eighty-five per cent of the firms report a tendency among employees to stay longer at their jobs. In about half the factories which reported inefficient employees have been laid off during the last few weeks. General wage increases are becoming less frequent. The large amount of business on the books and the continued shortage of many jobbers' stocks have led to the employment of additional labor in many establishments, but the employment departments are now better able to pick and choose than they were a few months ago.

Little complaint is heard as to labor shortage among the contractor-dealers, and relations are at present unmarred by serious disagreements. Jobbers and central stations are well provided with help. Some unrest has cropped up recently in the telephone field owing to the competition of rival union organizations for members, but no threats of a strike are heard. In the electric railway field the arbitration of demands for wage increases rules in most communities, and the great majority of employees are working regularly.

Plentiful Labor Supply in Other Sections

Electrical contractors in the South report a larger labor supply than has been the case for some time past. Wages remain very high, and the help is not particularly skilled or efficient. Railway employees in New Orleans have returned to work, together with the metal trade workers. The strike

in the coal fields in the Birmingham district is playing havoc with the shipment of coal, but, all in all, labor conditions in the South are reported somewhat more settled.

Reports from the Middle West indicate a distinctly better labor supply. In Chicago territory there is a gradual increase each week in the number of men out of employment. In Detroit there has been a decrease of slightly less than 7 per cent since April 1 in the working forces of seventy-eight firms employing 200,000 people, according to a statement of the Employers' Association of Detroit, the latter part of August.

In the Intermountain section of the West labor is plentiful in building lines. A more settled tone is evident since the settlement of recent disputes there. In Salt Lake City the strike of the International Brotherhood of Electrical Workers is over, and union labor in other cities has also settled its disagreements.

Less complaint is heard of labor conditions on the Pacific Coast, as few strikes or disturbances of any importance have recently taken place there. More men are being employed in electrical installation work this month than last in the Northwest. The supply of labor on the West Coast about equals the demand.

Prospects of a Shortage in Heating Appliances

ACCORDING to leading manufacturers of domestic heating appliances throughout the country, indications seem to point to a widespread shortage this fall. Demand in some cases is reported slightly less than two or three months ago, but it is still extremely active, especially on the part of consumers. Some manufacturers are finding demand from jobbers, dealers and central stations slightly off. This is thought to result from financial reasons and because there seems to be some feeling in the trade that lower prices will prevail late in the fall. Regarding the outlook for the autumn and holiday trade, producers are extremely optimistic. Excellent sales are generally anticipated. Factories are making every effort to prepare for the expected spurt in buying. Thus far, however, the volume of demand has kept well ahead of production in spite of all efforts.

As a rule, factory stocks are entirely depleted and large quantities of back orders have piled up. Manufacturers report that their distributers are also poorly supplied, with the exception perhaps of 6-lb. irons, which seem to be in a little better supply. The demand for flatirons for immediate shipment is quite heavy.

Difficulty in securing raw material has been one of the biggest adverse factors in coping with the demand. A decided improvement during the past month is reported, however, though the shortage in some lines, such as switches, heater cords and special wire, still continues. Deliveries range all the way from two to eight months and even as long as ten months on some devices.

Very heavy back orders have piled up in most cases, in spite of the fact that factories are shipping goods as fast as they can be manufactured. One of the largest appliance makers is finding the situation so serious that a quota has been placed on each district sales office and jobber, and shipments are allotted to them on the basis of a certain number of pieces each month.

Prices, it is stated, have ranged steadily upward, commensurate with increased costs of labor, raw material and overhead expenses. During the past two months price advances varying from 6 to 20 per cent on the whole line of heating devices have gone into effect. Opinions on the probable future trend of prices vary. Some manufacturers hold that the peak of prices has probably been reached, or at least that the present level will hold for some time. Several producers think the increase in freight rates may make another advance necessary. It seems likely that there may be a change in policy regarding transportation charges in some sections of the country. The cost of transportation now averages 25 to 40 per cent higher in certain zones. It is stated that there is nothing tangible upon which to base hopes of any price reductions. Almost no labor troubles are being experienced at present, and the supply of labor is also reported better.

Production in some instances ranges from 40 to 100 per cent ahead of last year, while other manufacturers say it is about normal and a few who have been hampered in obtaining necessary material report that they have not as yet been able to reach their capacity output. Collections in this line are said to be fairly prompt, averaging from thirty to sixty days in most cases.

JOBBERS' STOCKS ARE LOW

Regarding the domestic appliance situation as it affects jobbers throughout the country, conditions are little better than with manufacturers in so far as ability to meet the expected demand is concerned. In New England territory flatirons are plentiful in jobbers' hands, but the supply of toasters, percolators, small grills, etc., is none too good. Buying of bowl-type heaters has begun, and in spite of high prices a large volume of business is being done. In the South jobbers report that they are unable to accumulate sufficient stocks for the heavy fall trade that is anticipated. Shipments have not come through so promptly as was expected, and the brisk demand absorbs a major portion of all supplies received. The general estimate is that there is sure to be a shortage on the most popular lines this fall, with the exception of flatirons. In the East jobbers' stocks of appliances are badly broken, with the exception of 6-lb. irons, and considerable scarcity is expected to confront the fall trade. Deliveries are uncertain, and the supplies coming through are generally on orders months old. In the Middle West it is stated that at the rate new business is coming along it will require some months to catch up with orders.

On the other hand, in the Intermountain section trade in appliances is not up to the standard of other years and very high prices prevail. Jobbers' stocks are pretty well filled up except on the hollow-ware items, where there is some shortage. Distributers' stocks in the Northwest are reported to be in poor shape, but on the Pacific Coast, where there has been a dearth of hollow ware ever since last Christmas, percolators, etc., can now be obtained for the first time in many months.

Metal Market Situation

THE domestic market for copper continues quiet, but a slightly better tone is evident as consumers seem to be taking more interest. This is because current contracts are now running out and producers are confident that within the next two or three weeks a heavier buying movement must result to cover consumers' needs for November and December. Most producers have now made a concession to the dull market to the extent of shading prices ¼ cent for nearby delivery, and a few small producers have even quoted 18.50 cents on attractive orders. Future shipments are still held at 19 cents.

The outside market is less active as the cheap lots of copper at 18.12½ and 18.25 cents have been sold and the lowest price in the East is about 18.37½ cents delivered.

NEW YORK METAL MARKET PRICES

	—September 7—	—September 14—
Copper	£ s d	£ s d
London, standard spot	95 0 0	99 15 0
	Cents per Pound	Cents per Pound
Prime Lake	18.52–18.50	18.50–18.62½
Electrolytic	18.75	18.75
Casting	17.75	17.87½
Wire base	22.50–23.00	22.50–23.00
Lead, trust price	9.00	8.50
Antimony	7.12½	7.12½
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.25	8.00–8.25
Tin	45.25	45.00
Aluminum, 98 to 99 per cent	35.10	35.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15.50 to 16.00	15.50 to 16.00
Brass, heavy	9.00 to 9.25	9.00 to 9.25
Brass, light	7.25 to 7.50	7.00 to 7.25
Lead, heavy	7.25 to 7.50	7.00 to 7.25
Zinc, old scrap	5.25 to 5.50	5.25 to 5.50

THE WEEK
IN TRADE

REPORTS from all districts with the exception of Portland territory in the Northwest indicate a quiet volume of business. Though a heavier wave of buying is expected soon, it has not yet made its appearance. In the one exception noted sales are good and business is increasing. In the South pessimism is expressed as the result of rains that have injured the cotton crop. The general prosperity of the section is encouraging, however. In the Intermountain section of the West a slightly better buying tone on the part of the public is noticed, but conservatism is still the order of the day.

Slower collections are reported throughout the country except in the Intermountain district, where they are improving. This is probably a result of the third-quarter federal income taxes which were due on the fifteenth of this month. In many sections labor conditions are improved and a more plentiful supply is available. A few price changes on items such as conduit, bells and dry cells are reported. Stocks seem to be accumulating in good shape in most lines. Transportation conditions are better, especially in the Northwest, where a shortage of cars has long been felt.

NEW YORK

Some jobbers report that the volume of trade is slightly picking up, but on the whole the situation locally is still characterized as quiet. The spurt in sales as a result of the expected fall demand has not as yet made its appearance. Collections appear to be pretty tight in this district, and for the past few weeks customers have been slowing up in paying their bills.

Stocks are building up in good shape, and plentiful supplies in most lines are reported. There is still more or less shortage on some items such as outlet boxes, but the noticeable improvement in shipping conditions is slowly having its effect.

A few price changes have occurred in the past week. Dry cells have taken a jump, and the price of bells has been advanced about 25 per cent.

Rigid Conduit.—Export sales are increasing, but domestic demand in some quarters is said to be slightly less. Irregular shipments and badly broken stocks are the rule. Only one or two fortunate distributers report a good supply. The price for ½-in. black ranges from $85 to $93 per 1,000 ft., and for ¾-in. from $114 to $125. Some reports are received of increased prices to cover the new freight rates.

Non-Metallic Flexible Conduit.—Jobbers seem to be short on many sizes. Shipments are slow and demand holds up well. The price quoted for ⅜-in. is $32 and for ½-in. $35 to $36 per 1,000 ft., in coil lots or more.

Flexible Armored Conductor.—The current quotation for No. 14, two-wire, ranges from $100 to $104 per 1,000 ft. on large quantities. Small lots are quoted as high as $110 per 1,000 ft. Plentiful supplies are available and demand is decidedly off.

Bells.—A representative manufacturer has just announced price increases amounting to 25 per cent over the list that has been in effect since last spring.

Dry Cells.—New prices have just been announced. No. 6 is now quoted at 36 cents in barrel lots. In quantities under 125, the quotation is now 39 cents; in lots less than 50 the price is 45 cents, and under a dozen 50 cents. Conditions are the same as reported last week.

Fuses.—Demand is rather quiet. Good stocks of both renewable and non-renewable types are reported. Sales are expected to increase soon. The price of N. E. C. standard 250-volt non-renewable fuses, 3-amp. to 30-amp., ranges from 10 cents to 13 cents in the inclosed and about 5 cents to 5¼ cents in the plug type in standard-package lots.

Conduit Fittings.—Demand for fittings as condulets, etc., is said to be rather quiet. Stocks are in good shape and no trouble with shipments is experienced. The current discount on standard packages is 15 per cent, on one-fifth of a standard package 5 per cent, and on quantities less than that the quotation is list net.

Flashlights.—Some jobbers have been meeting a good demand, while others say sales have been not up to standard. Plentiful supplies and good shipments are the rule.

Flashlamp Batteries.—A somewhat heavier demand is reported than for flashlight cases. Stocks are well built up and supplies are easily obtained. A representative jobber's price for a three-cell, 8½-in. tubular battery is 27 cents in lots of 100, and for a two-cell, 3½-in. flat battery about 21 cents net in lots of 100.

CHICAGO

Electrical jobbers are as one in stating that the volume of new orders and the number of inquiries received have fallen off materially in the past few weeks. The situation is not alarming, the only surprise being that the lull did not come sooner. Jobbers' stocks as a whole are improving, although on many items shelves are still bare. The worst shortages are found in guy wire and on linemen's tools. On both these items factories are behind on orders, and on linemen's tools they have withdrawn prices.

Freight-rate revisions have occasioned new quotations in many lines. No changes are recorded on wire, as the decrease in the cost of cotton and rubber are offsetting the freight raise on insulated stock, while the makers of bare copper see fit to absorb the difference. Many reductions are being made in the forces of industrial plants.

Motors.—Inquiries as well as actual orders are reported less in sizes up to 200 hp. Deliveries are mostly very slow, but a few 40-hp. and 50-hp. motors are available for immediate shipment from factory. Makers are still working at top speed with no indications of a reduction in output.

Transformers.—New price sheets on General Electric transformers were issued this week, showing an advance approximating 10 per cent. Demand is heavy, particularly for farm lines. Deliveries on light transformers range from four to six weeks and on heavy power work from twelve to sixteen weeks.

Power Control and Protection Apparatus.—Conditions are practically unchanged. Deliveries of large-sized oil switches require about four months. Small sizes are in some cases available from badly broken stocks. Shipments of motor starters are still slow. Many motors are shipped with starters to follow. Lightning arresters are in fair supply, small quantities of most types being available from stock. Demand for circuit breakers is very slow.

Northern White Cedar Poles.—Producers report a satisfactory output in the woods. Car supply is now occasioning no great trouble, though little improvement in the time required for transit of goods is noted. No new lists have been issued, the actual increase in freight expense being added to the old quoted price. This increase in the Chicago district amounts to from about 25 cents on a 6-in., 30-ft. pole to $1.25 on a 7-in., 55-ft. pole.

Line Hardware.—New price lists have been issued amounting to an increase of about 5 per cent. Supply is erratic. The current price on galvanized pole steps, ⅝ in. x 9 in. is $92.51 per 1,000 in quantities of from 500 to 1,500, and $104.10 per 1,000 in lesser quanities. Galvanized machine bolts, ⅝ in. x 10 in. are $13.99 per 100 in large quantities and $15.74 per 100 in small lots. No advance was recorded on cross-arm braces.

Electric Heaters.—Brisk trade has been the rule all season. Householders are buying to forestall the coal shortage. Manufacturers have been able to fill the demand of the trade in all sizes. The most popular variety is a single unit retailing for about $12.

Curling Irons.—Dealers report that trade so far this season is heavier than ever before. The "Hotpoint" list is $7.50 each, complete with comb.

BOSTON

A sustained recession in trade continued although a good volume of business is being handled from week to week. Building operations are falling off somewhat. Manufacturers are beginning to catch up on deliveries and jobbers are finding less difficulty in replacing stocks. Rigid conduit is still scarce, transportation conditions being unsatisfactory.

Collections are being pushed closely. Appliance sales are not so large as was expected, and holiday stocks are accumulating in some quarters. Flexible armored conductor and pull sockets are in better supply. "Nail-it" knobs are firmer in price. Porcelain and small motors are slightly improving in deliveries. Labor conditions continue steady and quiet. The larger woolen mills of New England were scheduled to resume production this week.

Wire.—With the exception of magnet wire, fair stocks are in hand. Demand is excellent. Rubber-covered wire No. 14 is selling for about $11 per 1,000 ft. in 1,000-ft. lots. Bare copper wire quotes on 24 cents base and weatherproof on 29 cents. So far the lower price of cotton has not had much effect on wire prices.

Flexible Armored Conductor.—Single-strip No. 14 sells for about $100 in 1,000-ft. lots, reflecting easier conditions. Demand is good, and current requirements are being well handled.

Non-Metallic Flexible Conduit.—Owing to moderate demand and improved deliveries, stocks are not being reduced to any serious extent. Prices are steady, $\frac{7}{32}$-in. loom being quoted at $33.50 per 1,000 ft. in 5,000-ft. lots and $\frac{1}{4}$-in. loom at $36.50.

Dry Cells.—Stocks show considerable improvement over conditions earlier in the year. A good staple demand exists, with a tendency toward larger replacement orders. The No. 6 cell brings $32.95 per 100 in barrel lots, $33.95 being quoted on ignition cells in the same quantity.

"Nail-it" Knobs.—A better supply is coming through, but no overstocks are reported. Prices are firmer, a going quotation being $36.75 per 1,000 in barrel lots.

Sockets.—Pulls are easier in price, 50 cents net each being asked in case lots. Keys and keyless sockets are selling at 28 cents and 26 cents respectively. A fair demand exists, with excellent supply.

Tape.—Friction tape is plentiful, black $\frac{3}{4}$-in. being priced at about 65 cents per pound in 25-lb. lots. Current requirements are being served with ease.

Heaters.—Stocks are being built up against the fall demand. Good sales in the Northeastern coast resorts are reported for the season now closing. Owners of large cottages in the mountain resort district have bought well in response to a 3.5-cent energy rate established in the spring. Jobbers are quoting 25 per cent off list in lots of six.

Rigid Conduit.—Slow deliveries are causing jobbers to husband their incoming shipments for distribution to regular customers. Back orders absorb new supplies soon after their receipt. Prices are firm after the recent increase, typical quotations being as follows on 1,000 ft., in lots less than 2,500 lb.: 1-in. black, $188; 1-in. galvanized, $198; $\frac{1}{2}$-in. black, $97; $\frac{1}{2}$-in. galvanized, $103.

ATLANTA

Continued rains throughout the section have probably damaged and materially retarded the cotton crop. The report of cotton ginned to Sept. 1 for this section was only about 20 per cent of the amount ginned prior to Sept. 1 last year. The lack of optimism is reflected in slower collections of electrical interests. Jobbers are endeavoring to tighten up slightly on credits in order to reduce overextensions and offset slow collections.

In contrast with the feeling of depression resulting from the unsettled weather conditions, it is interesting to note the general prosperity of the section during the past year as evidenced by the amount of internal revenue taxes paid. These figures indicate that the average amount paid by the six great agricultural states of the South was approximately 40 per cent more than the average amount paid per state by the six great agricultural states of the Central West.

Building permits in Atlanta for the last half of August show a slight increase over the first half of the month.

Schedule Material.—In spite of reduced residential construction demand is active, probably owing to some extent to renovating and small mill work. Prices are steady and shipments as good as can be expected under prevailing conditions.

Lamps.—Sales show continued gains and supplies are apparently holding up well.

Fuses.—Demand is excellent and jobbers and contractor-dealers report considerable activity. The renewable fuse has evidently come into popularity as evidenced by the number of orders received for parts.

Electric Ironers.—Campaigns by jobbers are stimulating business. The field has been worked only slightly in this section and manufacturers and jobbers are beginning to realize the possibilities in this line.

Washing Machines.—Sales have slowed up somewhat in the past two weeks and jobbers have accumulated considerable stocks. Jobbers anticipate more active sales in the next thirty days. Shipments are coming through very satisfactorily.

Annunciators and Fire-Alarm Equipment.—Jobbers have been advised this week of an increase in price on this equipment. Demand holds up, but the increase in price apparently is not the reflection of demand.

Poles.—The call for poles continues brisk. The lack of transportation facilities is seriously hampering deliveries in this section. Prices remain stable, though a slight advance is anticipated as a result of the recent increase in freight rates.

Distributing Transformers.—The shortage in this line continues acute, with little relief in sight. Local stocks are exhausted and long deliveries are quoted. Demand, however, continues strong.

Wire and Cable.—Demand continues on about the same level except for heavy cable, which has been somewhat stimulated by the recent placing of contracts for large mill jobs. Some local jobbers report good recent receipts of rubber-covered.

ST. LOUIS

Jobbers report a fair movement of electrical supplies and material during the past week, though fall buying has not made itself very manifest so far. Stocks are more nearly normal in all but a few lines than for some time.

Building work which had been stopped when the teamsters' strike held up needed material has been resumed. East St. Louis building permits for August show a large increase over August of last year. The big majority of the work is for industrial plants. Further progress in the clearing-up of freight accumulations and blockades at many points is being made in this section. As a result deliveries are much improved.

Collections are becoming more difficult. One manufacturer is offering a discount of 5 per cent for cash, a policy never before followed by that firm.

Transformers.—Single-phase, 2,300-volt distributing transformers up to 100 kva. and even 150 kva. are in great demand by central stations. Very small stocks are available in the hands of jobbers or local manufacturers. Three months' delivery is the average.

Conduit Fittings.—Adequate stocks are in jobbers' warehouses to meet the present steady demand. No price change has been made corresponding to the increase in the price of conduit.

Line Hardware.—Demand from central stations is very good and practically all orders are being shipped from jobbers' stocks. There is no change in price.

Hollow Ware.—Dealers are fairly well stocked and jobbers are beginning to get their reserve stocks in shape to handle the Christmas business. "Loving-cup" percolators are still somewhat scarce. Dealers report a fairly good demand with little dissatisfaction over present high prices.

Irons.—Stocks are in good shape and shipments from factories are sufficient to offset the extensive sales of local retailers.

Washing Machines.—Business has fallen off all along the line. Plentiful stocks are available. Prices are steady.

Fractional Motors.—Cancellations have now reached the larger manufacturers, and as a result large orders for certain types and sizes can now be delivered from stock.

Ranges.—Good stocks of various sizes and types are available for prompt delivery, but orders are very slow.

Lamps.—Business has been good. Complete stocks are in most instances available except for the large sizes. Lamps of 75 watts to 200 watts, type C, are more difficult to obtain, and it may be three months before reserve stocks of these have been built up by all jobbers. Stocks of series lamps for street-lighting purposes are spotty and demand is growing.

Porcelain Insulators.—There is a steady demand for insulators around 33,000 volts. Stocks are very incomplete. Some factories do not promise delivery before January or February, 1921. There are plenty of 6,600-volt insulators available.

SAN FRANCISCO

Business is quieter. Building permits are running considerably below last year's rate, except in southern California. Labor is growing more plentiful and many contractors are working only a small proportion of their regular force. Collections are rather slow and credit is being extended very sparingly.

On the other hand, the completion of new power projects will cause a much-needed expansion and distribution of current into new territories. Serious efforts are being made to interest the electrical trade more in the sale of power securities, for money is needed badly to finance the new work.

Poles.—The market is in a disturbed state, though prices have not greatly advanced despite increased freight rates. Stocks are very poor because of the lack of cars to bring supplies from the mills. The higher wages of lumbermen are also an indirect factor in this poor distribution, because mill owners cannot count on the services of their men for as long a time as they used to be able to do.

Cross-Arms.—The supply is affected by the same causes that cover the inability of jobbers and dealers to accumulate well-balanced pole stocks.

Washing Machines.—Several of the standard cylinder makes have advanced in price. The average swinging wringer machine now sells for $180 f.o.b. Pacific Coast. Stocks are good.

Electric Ranges.—This has been a most exceptional year in the sale of hotel ranges, bake ovens and other heavy-duty appliances. Good sales have been made to summer resorts. Good business from the United States government is also reported. Even better sales are expected to result from the success of present installations in various army posts.

Household Appliances.—Considerable discussion is current over the proper discounts to be allowed dealers. It is felt that further investigation is needed into the especial overhead required.

SEATTLE—PORTLAND

Jobbers in Seattle and Puget Sound cities report that fall trade as a whole is dull. An exception is noted in the increasing movement of household appliances, particularly ranges, washing machines, heating devices, vacuum cleaners, etc. Seattle jobbers are obtaining all of this class of material that they need, but there is a decided shortage on ranges and hollow ware. Conduit also remains scarce but call is light. Weather conditions in the Pacific Northwest for the past week were very favorable for harvesting crops. The transportation situation has materially improved as transcontinental railroads serving the Puget Sound district are now filling at least 50 per cent of all car orders.

Bids will shortly be called in Portland on equipment for a 15,000-ton drydock, including four electrically operated capstans, floodgates, sluicegates, valve stems, and ten 100-hp., 440-volt motors. Jobbers in the Portland district report good business the last week or two, with a decided upward tendency. Demand is especially good for pole-line material, lamps, conduit and wire. Stocks are in about the same condition as reported for several weeks past. Conduit is very short, however, particularly in the small sizes. Previous to the advance in freight rates there was an unusual volume of goods shipped, and the resulting freight congestion has served to slow down deliveries.

Credit and collections remain unchanged. It is not expected that much improvement will be shown until after crops are marketed and the Presidential election is over. Portland dealers report good business. There has been a perceptible improvement in sales the past week. Demand for lamps and washing machines is picking up and this improvement is about three weeks earlier than the usual fall demand starts. The price on No. 14 rubber-covered wire in less than 500-ft. lots is $19.20 per 1,000 ft.; 500 to 5,000 ft., $16, and in lots of 5,000 ft. and over, $15.20. Weatherproof solid-conductor, triple-braid, No. 0 to No. 4/0, less than 500 lb., $39 per 100 lb.; 500 lb. to 1,000 lb., $34, and 1,000 lb. and over, $33.

SALT LAKE CITY—DENVER

Electrical dealers observe a slight increase in the demand for domestic appliances. They regard it as a hopeful sign, an indication that people are ready to spend money when they have it.

The buying attitude of the public is much improved. Buyers seem less suspicious that prevailing prices are exorbitant. They are more willing to concede that there is an economic condition that largely controls prices instead of their being fixed in an arbitrary way. Marked conservatism in buying is still evident, however. High-priced merchandise is not in demand. Shoppers are demanding goods of second-rate. Hasty buying seems a thing of the past. Collections are improving month by month. Dealers in some quarters believe that prices on electrical cooking appliances are higher than the cost of manufacture and haulage warrants. They would welcome substantial reductions as a stimulant to retail buying.

Shipments are greatly improved. Neither dealers nor jobbers experience much difficulty in getting adequate stocks.

Heating Appliances.—Demand is anything but brisk. High prices discourage retail buying. One representative dealer believes that prices on this line of merchandise are 20 per cent too high.

Motors.—Supplies are plentiful. Dealers report a steady demand for all sizes and kinds.

Electric Ironers.—Thus far this year sales have been light. Interest seems to be awakening in this line, however. Dealers believe the time is near when ironers will be regarded as an indispensable feature of the household equipment.

Sewing Machines.—Not so many are being sold this year as last, some dealers report. The retrenchment in wearing apparel is held responsible for the falling off in demand.

Washing Machines.—Some jobbers and dealers are overstocked. Manufacturers seem unduly eager to unload on their jobbers.

Vacuum Cleaners.—Demand is satisfactory. Intensive advertising is given much credit for activity in this field. The need of equipment for fall housecleaning is also a contributory cause.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Oil and Water Strainer

The Griscom-Russell Company, 90 West Street, New York, has placed on the market a "G-R" strainer which may

STRAINER TO PURIFY OIL OR WATER

be installed either as a single unit or as a set of two. The strainer is made in sizes for 1-in. to 6-in. pipe.

Electric Sign Color Hoods

For gaining color effects in electric displays, the Reynolds Electric Company, 2650 West Congress Street, Chicago, has brought out colored glass hoods designed to slip over a lamp to do away with dipping. The hood is held in place by a spring fastener and is made in five colors, ruby, opal, amber, blue and green. Facility in attaching the hood, economy and lasting color qualities are the advantages claimed.

Mine Locomotive Headlight with Spring-Suspended Case

In the mine locomotive headlights placed upon the market by the Westinghouse Electric & Manufacturing

LAMP CASE SUSPENDED BY SPRINGS

Company the incandescent lamp case is carried on a spring suspension to protect the filament from breakage due to vibration. The frame, case and cover of this headlight are made of high-grade cast iron. The lens holder is fitted to the case with a threaded joint and rubber gasket.

Alternating or Direct-Current Bell

A new type of bell, the A. D., operating, according to the manufacturer, equally well on alternating and on direct current of the proper voltage, from 4 to 110, is being put out by the Holtzer-Cabot Electric Company, Roxbury, Boston, Mass. The bell is designed so that the speed of the hammer is independent of the frequency of the current. A new principle in bell construction is used, consisting of a buckled steel spring coupled to the armature so that each stroke is very positive in action. The coil is wound on a laminated core and the hammer is under the gong.

Plug Adapter

For connecting Edison screw plugs into Spartan receptacles an adapter made of substantial molded insulation has been brought out by the Bryant Electric Company of Bridgeport, Conn.

CONNECTS SCREW PLUG TO SLOTTED RECEPTACLE

It consists of a combination Spartan standard parallel-blade plug and an Edison base receptacle. The catalogue number is KL; the same device in porcelain is No. KF. When polarity connection is desired the numbers are ML and MF, respectively.

Notes on Recent Appliances

Bushings for Rigid-Steel Conduit

Walker Brothers & Haviland, Otis Building, Philadelphia, have recently put on the market a zinc bushing under the trade name of "Bushette" for rigid-steel conduit.

Electric Cloth Cutter

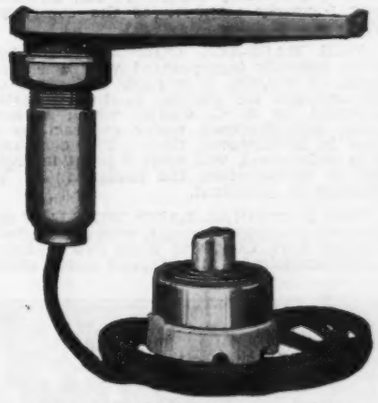
The Simplex Cloth Cutting Machine Company, 169 West Twenty-first Street, New York City, has brought out a motor-driven cloth cutter.

Motor-Driven Liquid Stirrer

A device for stirring chemicals and other liquids in the laboratory has been developed by the Central Scientific Company, 460 East Ohio Street, Chicago, Ill. The device may be attached to any support stand and the speed is variable from zero to 3,000 r.p.m. It is made for 110-volt or 220-volt alternating or direct current.

Immersion-Type Water Heater

A water heater adapted for use with sterilizers, glue pots, paste kettles, stills, etc., has been developed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., which is de-

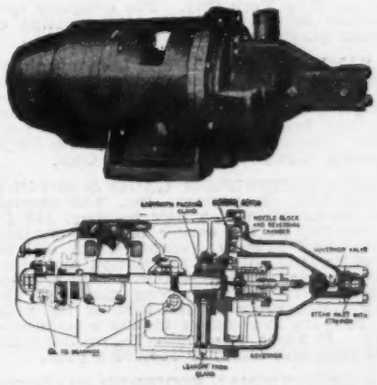


RIGID CASE TO PROTECT HEATING ELEMENTS

signed for permanent attachment within the bottom of the utensil. The nickel-chromium heating elements are incased in flat brass castings, which protect them from mechanical injury. The heaters are made for standard voltages and in 300, 600 or 1,200-watt size.

Turbine Generator Units for Locomotive Headlights

Although developed especially for supplying energy for locomotive headlights, the turbo-generator just placed upon the market by the Westinghouse Electric & Manufacturing Company may be used as a portable unit for other lighting service. It is designed for



LIGHT PORTABLE TURBO-GENERATOR

severe outdoor service. It can be set up on a floor, on a heavy board or in any other horizontal place.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE KLEINSCHMIDT ELECTRIC COMPANY, 36 Flatbush Avenue, Brooklyn, N. Y., manufacturer of electrical apparatus, has filed notice of increase in capital stock from $100,000 to $500,000.

THE RELIANCE ELECTRIC & ENGINEERING COMPANY, Cleveland, has appointed George Sherrerd, Jr., manager of its New York sales office, succeeding Samuel G. Boyd, recently resigned. Mr. Sherrerd was formerly manager of the company's Philadelphia office.

THE RADI-ALL COMPANY, Ironton, Ohio, recently incorporated with a capital stock of $50,000, it is said, will place on the market an electric heating radiator invented by J. C. Clutts, which is now being manufactured under contract by a firm in Middletown, Ohio. The company, it is understood, will erect a plant in Ironton to manufacture the radiator. R. W. Blanton is president.

THE NATIONAL LAMP WORKS of the General Electric Company, with main offices in New York City, will build two factories in Indianapolis to manufacture incandescent lamps representing an investment of about $2,000,000 on a site at East Washington and Gray streets. It is proposed to build a finishing plant of three stories and a basement, 111 ft. 240 ft., to cost about $1,000,000, and a glass works of two stories and a basement, 80 ft. x 200 ft., at a cost of about $750,000. About 1,200 persons will be employed in this finishing plant and 500 at the glass works. The proposed plant will manufacture miniature incandescent and automobile lamps, and will have a capacity of 150,000,000 lamps a year.

REGINALD PELHAM BOLTON announces that James A. McHollan is now associated with him in consulting engineering practice as vice-president of the R. P. Bolton Company, 116 East Nineteenth Street, New York City. The company specializes in power plants, electrification of steam plants, etc.

SAMUEL G. BOYD has been appointed manager of the electric motor department of the Fairbanks Company, Philadelphia, effective Sept. 1. For the past few years he has been manager of the New York sales office of the Reliance Electric & Engineering Company, Cleveland, Ohio.

THE PITTSBURGH GAGE & SUPPLY COMPANY, Pittsburgh, Pa., has started the construction of a new building, 150 ft. x 170 ft., at the corner of Twenty-ninth Street and Liberty Avenue, which will be used for the cutting, fabrication and storage of pipe. The company is now producing 150 Gainaday washing machines per day and expects by the first of the year to increase the output to 300 machines a day. It plans eventually to manufacture 500 machines daily, or 150,000 a year.

THE NATIONAL SWEEPER DIVISION of the Torrington (Conn.) Company has recently purchased additional plant facilities at Worcester, Mass., for the manufacture of the Torrington electric vacuum cleaner. The new unit includes buildings, comprising more than 100,000 sq.ft. of additional floor space.

THE APEX ELECTRIC DISTRIBUTING COMPANY, Cleveland, Ohio, has announced a new $5,000 prize sales contest for Apex cleaner salesmen, to close Sept. 25. The distributer's wholesale and retail salesmen are eligible to compete.

THE FLEXIBLE STEEL LACING COMPANY, manufacturer of Flexco lamp guards, Flexco-Lok lamp guards, alligator steel belt lacing, etc., is now in its new factory at 4607-4631 Lexington Street, Chicago, Ill.

THE WISE ELECTRIC SHERARDIZING COMPANY, Detroit, Mich., has acquired the property of the Acme Plating & Specialty Company at 915 Fort Street, where it will establish branch works.

THE WILLYS-LIGHT DIVISION, of the Electric Auto-Lite Corporation, Toledo, Ohio, recently held a four days' convention at Toledo, which was attended by 150 sales representatives of the company, representing sixty-five sales organizations and territories in all parts of the country. The sales organization of the company now extends to every section of the United States, and through the John H. Willys Export Corporation to twenty-seven foreign countries. Plans were outlined for marketing the farm-lighting plants to be manufactured this year by the corporation, and trips were made through the plants of the company. Walter H. Roberts, general sales manager, presided over the convention.

THE CROWN CHANDELIER COMPANY, 103 Mott Street, New York City, manufacturer of gas and electric fixtures, has filed notice of increase in capital stock from $15,000 to $60,000.

THE CONSOLIDATED WIRE AND MACHINERY CORPORATION, 519-527 West Van Buren Street, Chicago, is issuing a loose-leaf price list of new and second hand motors, Kuhlman transformers and miscellaneous materials.

THE MONROE-LOUISIANA CARBON COMPANY, Monroe, recently organized, contemplates the construction of a large carbon plant at Hancock, near Monroe, to cost, including equipment, about $1,000,000. Barney Oakland of Monroe is superintendent.

THE LAKEWOOD ENGINEERING COMPANY, Cleveland, Ohio, announces the appointment of Robert M. Gates as managing engineer in charge of the Philadelphia district, with offices at 1034 Widener Building, Philadelphia.

THE WESTINGHOUSE LAMP COMPANY, 165 Broadway, New York City, is asking for bids for the construction of a four-story factory, 100 ft. x 200 ft., on La Salle Avenue, Indianapolis, Ind., to cost with equipment $2,000,000.

THE RAUCH & LANG COMPANY, Chicopee Falls, Mass., is reported to have awarded contract for its new automobile plant in the Willimansett section of Chicopee, consisting of a main building, 300 ft. x 325 ft., and several adjoining buildings. The total cost is estimated at $300,000.

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, has purchased a plant on Home Street, Xenia, Ohio, which was formerly used to manufacture fuses. The company will utilize the building as a tool room in connection with its Xenia plant.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is having plans prepared for a five-story factory addition, 70 ft. x 400 ft., to its Pittsfield Works.

THE PROGRESSIVE ELECTRIC PRODUCTS COMPANY, 2711 Church Avenue, Cleveland, Ohio, recently organized, has taken over the plant and business of the King Electric & Manufacturing Company, Cleveland. E. P. Maureer, formerly manager and owner of the King company, continues at the head of the production department of the new company.

THE VARNEY ELECTRIC COMPANY, Evansville, Ind., manufacturer of electrical equipment, recently lost a portion of its plant by fire. The damage is estimated at about $100,000.

THE MARION INSULATED WIRE & RUBBER COMPANY, Marion, Ind., has awarded contract for a three-story-and-basement, 35-ft. x 60-ft. extension to its plant.

THE NEW JERSEY GAS & ELECTRIC COMPANY, Newark, N. J., recently incorporated to manufacture gas and electric appliances, has acquired property at 36½ New Street, where it will establish a plant.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has acquired the five-story, 60 ft. x 242 ft. factory of the Randal-Faichney Company at 76 Atherton Street, Roxbury, Boston, together with a large power plant.

SALES CONVENTION OF WILLYS-LIGHT DIVISION, ELECTRIC AUTO-LITE CORPORATION

THE CHAMPION ENGINEERING COMPANY, Kenton, Ohio, manufacturer of electrically driven traveling cranes, etc., will soon award contract for the construction of a 500-ft. addition to its gray-iron foundry. Bids are also being received for equipment. New buildings which will double the present capacity of the plant will be opened in the near future.

Supply Jobbers' Notes

THE W. C. NAGLE ELECTRIC COMPANY, Toledo, Ohio, has filed notice of increase in capital stock from $125,000 to $225,000.

THE AMBER ELECTRICAL SUPPLY COMPANY, 553 West Madison Street, Chicago, is planning to erect a seven-story building with basement, 68 ft. x 75 ft., at the corner of Desplaines and Adams Streets, to cost about $250,000.

Foreign Trade Notes

THE WESTERN ELECTRIC COMPANY ORGANIZES COMPANY IN ARGENTINA.—G. E. Pingree, vice-president of the International Western Electric Company, has announced the organization of a new company in Argentina, to be known as the Compañia Western Electric Argentina, which will take care of the telephone requirements of the countries in the lower part of South America. The capital stock of the new company consists of 5,000 shares of 100 pesos each. Its headquarters will be at Buenos Aires. H. C. Mitchell, who formerly acted as resident manager for the Western Electric Company in South America, has been elected president.

ORGANIZATION OF ELECTRICAL INTERESTS IN AUSTRALIA.—Owing to the lack of co-operation between the technical societies and organizations which represent the various branches of the industry in the Commonwealth of Australia, steps are being taken by the Electrical Traders and Contractors' Association of Victoria to reorganize the association and to bring into closer co-operation all the electrical interests in the state. In an article written by L. G. Hinwood on "Co-operation for Improvements of the Electrical Industry" the present unsatisfactory position was dealt with. He stated that the electrical industry was probably the only one in Australia which was not making money. Mr. Hinwood advised the Victorian Association to adopt American methods. He estimated that there was an immediate demand in Victoria for 50,000 fan motors, 50,000 vacuum cleaners, 50,000 electric irons, 50,000 kettles, 50,000 washing machines and 50,000 table standards and that there were 135,000 dwellings to be wired. The value of the articles and work he estimated at over £5,000,000, and only organization and industry would secure it. As a community, he said, they were doing nothing to convince those householders of the advantages of electricity. The membership of the association consists of nineteen importers and twenty-three contractors out of 241 contractors.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A trading company in Holland (No. 33,630) desires to purchase and secure sole agencies for appliances to be used in the electrification of railroads.

A mercantile firm in France (No. 33,637) desires to purchase sheet iron for the construction of electric generators, 1 m. x 2 m. x 4 mm.

A machinery importing company of the Netherlands East Indies (No. 33,640) wishes to establish business relations with manufacturers of electrical equipment with a view to obtaining large quantities for large installations.

An agency is desired by a mercantile company in India (No. 33,648) for the sale of electric lighting sundries, fans, etc.

Trade Publications

SALES ENGINEERING—The J-B Engineering Sales Company, Hartford, Conn., is distributing a four-page leaflet containing a short article on the profession of sales engineering.

ELECTRIC SWEEPER.—The Pneuvac Company, Worcester, Mass., has issued a booklet entitled "Electric Sweeper-Vac with Motor-Driven Brush," in which it describes and illustrates its electric sweepers.

INSULATORS.—The Jeffrey-Dewitt Insulator Company, Huntington, W. Va., is distributing catalog No. 3, entitled "Rugged Insulators," covering different types of its disk insulators, etc.

ELECTRIC SHOVELS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing motor application circular No. 7132, entitled "Electrification of Excavating Shovels," which describes and illustrates the various uses to which electric shovels may be put.

ELECTRIC GEAR SHIFT.—"The C-H Magnetic Gear Shift" is the title of a sixteen-page booklet, known as publication 849, published by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., which explains the operation of the C-H magnetic shift.

WATER SOFTENER.—The Graver Corporation, East Chicago, Ind., is distributing bulletin 509, describing and illustrating the Graver Zeolite water softener.

SWITCH BOXES.—The Appleton Electric Company, Chicago, Ill., has issued bulletin No. 14, in which is listed a complete line of solid and sectional switch boxes with bevel and square corners, furnished for loom and flexible conduit, also ½-in. and ¾-in. rigid conduit.

New Incorporations

THE HERCULES MANUFACTURING COMPANY, Indianapolis, Ind., has been chartered with a capital stock of $400,000 by Jackson Carter, E. M. McDaniel and W. L. Taylor. The company proposes to manufacture electrical machinery.

THE WALTER H. TAVERNER CORPORATION, New York, N. Y., has been incorporated by W. H. Taverner, R. B. Fenner and H. S. Lockwood, 1811 Avenue J, Brooklyn, N. Y. The company is capitalized at $60,000 and proposes to manufacture electrical machinery and parts.

THE AUTOMATIC SCREW CAPPING CORPORATION, Ridgeway, N. J., has been incorporated with a capital stock of $200,000 to manufacture special machinery, electrical equipment, etc. The incorporators are J. V. Ryan, Eble and Charles W. G. Baiter.

THE E. G. WENTWORTH MANUFACTURING COMPANY, Indianapolis, Ind., has been incorporated by E. G., Charles O. and M. W. Wentworth. The company is capitalized at $100,000 and proposes to manufacture automatic light controllers.

THE T. A. F. ELECTRIC EQUIPMENT COMPANY, 255 West Sixtieth Street, Los Angeles, Cal., has been formed to manufacture electrical devices. W. R. Fowler and John F. Andres are interested in the company.

THE RELIABLE ELECTRIC COMPANY, Newark, N. J., has been incorporated with a capital stock of $100,000 to manufacture electric appliances and fixtures. The incorporators are William Gross, 158 William Street, and Samuel Gross, 124 Little Avenue, Newark.

THE SAYLERSVILLE (KY.) HEAT & LIGHT COMPANY has been incorporated with a capital stock of $10,000 by Samuel J. Patrick, H. H. and I. E. Ramery.

THE SOUTH BOSTON (VA.) POWER COMPANY has been incorporated with a capital stock of $500,000. T. C. Watkins, Jr., is president and W. A. McCanless is secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CALAIS, VT.—The Hughes Granite Company, care of Walker & Walker, 101 State Street, Montpelier, plans to lay six miles of electric freight railroad for its own use, from Calais to East Montpelier.

CHELSEA, MASS.—Additions and alterations to the lighting system at the naval hospital are contemplated.

CRANSTON, R. I.—The Narragansett Finishing Company has plans under way for the erection of a power house, 45 ft. x 65 ft., at its textile plant.

MIDDLETOWN, CONN.—The New England Enameling Company has plans under way for extensions to its power plant and the installation of a new electric distribution system at its works. Westcott & Mapes, Inc., 207 Orange Street, New Haven, are engineers.

Middle Atlantic States

BUFFALO, N. Y.—Plans have been filed by Julius Schultz, architect, 1370 Main Street, for the erection of a power house at 835 Washington Street. Work will be done by day labor.

CANANDAIGUA, N. Y.—The Miller Corset Company contemplates the erection of a power house in connection with the proposed new factory on Chapin Street. The total cost is estimated at $100,000. E. H. Miller, 67 Court Street, Cortland, is president.

CORNING, N. Y.—Tentative plans are under consideration by the Corning Glass Company for the erection of a power plant at its works.

GLENS FALLS, N. Y.—The International Paper Company contemplates an expenditure of about $1,000,000 on the development of water power in the Hudson River near this place. Preliminary plans are under way for the erection of a plant on Sherman's Island and a dam. Floyd G. Simons, 30 Broad Street, New York City, is superintendent.

HAMILTON, N. Y.—Bonds to the amount of $28,000 have been voted for improvements to the municipal light plant.

NEW YORK, N. Y.—The Electric Bond & Share Company, 71 Broadway, has arranged for an issue of $4,000,000 in bonds, part of the proceeds to be used for extensions and improvements to the plants of two of its subsidiaries, one of which is the Southwestern Power & Light Company, El Paso, Tex.

ELIZABETH, N. J.—The Willys Corporation, Newark Avenue, contemplates the erection of a large power house in connection with its new automobile manufacturing plant now under construction. The initial station will have a capacity of about 6,000 kw. J. V. Hall is general manager.

JERSEY CITY, N. J.—The M. W. Kellogg Company, 117 West Side Avenue, manufacturer of power plant piping, etc., contemplates the construction of three shops. Plans also include the erection of a power house.

JERSEY CITY, N. J.—The Tidewater Oil Company, Bayonne, contemplates the erection of a power house and pumping plant on the Morris Canal at Jersey City.

RIVERTON, N. J.—The Campbell Soup Company, Camden, has plans under way for the construction of a power house at its farm in Riverton.

TRENTON, N. J.—The Cook Linoleum Company, East State Street, has plans under way for the construction of a power house at its plant.

TRENTON, N. J.—The City Commission has under consideration a report by Prof. C. E. Clewell of the University of Pennsylvania covering suggestions for extensions and improvements to the local street-lighting system.

CHAMBERSBURG, PA.—Application has been made to the Public Service Commission by the Warmspring Road Telephone Company for permission to install a system in parts of Franklin County.

CLARKSVILLE, PA.—The Furness Corporation, 343 South Dearborn Street, Chicago, Ill., is planning for the erection of a power plant for service at its proposed clay products plant at this place.

DARBY, PA.—The installation of an electric street-lighting system in the borough of Collingdale is contemplated. S. G. Davenport is chairman of the committee at Collingdale.

MECHANICSBURG, PA.—The erection of a hydro-electric power plant in this section is being planned for by the New Era Hydro-electric Company, recently incorporated with a capital of $250,000. Arthur C. Watkins of Mechanicsburg and others head the company.

PHILADELPHIA, PA.—Contract has been awarded to Fred A. Havens Company, 845 North Nineteenth Street, by the Pennsylvania Railroad Company, Broad Street, for the erection of an addition to its substation at the Arsenal bridge, to cost about $40,000. Cam Rea is president.

UNIONTOWN, PA.—The board of directors of the Uniontown Hospital is planning the erection of a new power house and laundry plant at the institution to cost about $30,000.

BALTIMORE, MD.—Bids will be received by Mayor W. F. Broening, president of the Board of Awards, until Sept. 22 to repair power plant at the Bayview Hospital.

HUNTINGTON, W. VA.—The Borderland Coal Corporation contemplates rebuilding the power house at its mine No. 2, recently destroyed by fire.

MADISON, W. VA.—Plans are under consideration by the Madison Water & Light Company for the erection of a power plant to cost about $25,000.

RICHMOND, VA.—Bids will be received by E. W. Trafford, superintendent of Public Utilities, until Sept. 20 for switchboard apparatus.

WASHINGTON, D. C.—Plans are filed in the office of the Chief Engineer, Washington, D. C., awaiting approval, for certain facilities including electrically driven pumps for the Key Bridge.

North Central States

CLEVELAND, OHIO.—Separate bids will be received at the office of the Commissioner of purchases and supplies, City Hall, until Sept. 24, for weatherproof copper wire, paper-insulated, copper-incased cable and electric meters; until Sept. 23, for about 53,961 ft. of underground lead cable for the division of fire-alarm system.

BLACKEY, KY.—The Dudley Coal Company contemplates the erection of a power house.

BLUEFIELD, KY.—The erection of a power house and tipple is contemplated by the Ulvah Coal Company.

DAVID, KY.—The Marion Coal Company plans to construct a power house, tipple, etc.

WINDOM, MINN.—Bonds to the amount of $17,000 were voted for improvements to the power plant and waterworks.

SIDNEY, NEB.—The city officials contemplate electrical improvements to cost about $70,000. Royal D. Salisbury, 1415 East Colfax Avenue, Denver, Col., is engineer

ATHOL, KAN.—Plans are under way for electrical improvements in Athol to cost about $12,000. Clarence E. Reid of Manhattan is engineer.

WILSEY, KAN.—The city officials contemplate electrical improvements in Wilsey to cost about $18,000. Clarence E. Reid of Manhattan is engineer.

Southern States

CHARLOTTE, N. C.—The Great Mountain Power Company has been incorporated with a capital of $2,000,000 and contemplates the erection of a hydro-electric plant. H. S. Taylor and G. B. Chapin head the company.

NEW HOLLAND, N. C.—Bids have been received by Benham & Richard, Columbus, for the installation of electric lighting, water and sewer systems for the North Carolina Farms Company, New Holland. The cost is estimated at about $50,000.

NORTH WILKESBORO, N. C.—The city officials are considering the installation of electric light and water systems to cost about $30,000.

REBECCA, GA.—A committee has been appointed to arrange plans and means for the installation of electric lights in the town.

ROCHELLE, FLA.—Bonds to the amount of $45,000 have been voted to purchase new equipment for improvements to the power plant.

DOTHAN, ALA.—The erection of a hydro-electric plant on the Choctawhatchee River is contemplated by the city officials.

FORT PAYNE, ALA.—The Wills Valley Light & Power Company has been organized with a capital of $75,000 and contemplates the erection of a hydro-electric plant on Wills Creek at Hughes Mills.

LOUISVILLE, MISS. — An issue of $36,000 in bonds has been arranged by the Town Council for the establishment of an electric light and power plant.

WICHITA FALLS, TEX.—Bids will be received by the State Board of Control, Austin, until Oct. 4 for the installation of electric wiring in buildings of the Northwest Texas Insane Asylum. C. H. Page & Brothers, Austin, are architects.

Pacific and Mountain States

SEATTLE, WASH.—According to W. F. McAuliffe, local manager of the Radio Corporation of America, the company plans to install a commercial radio station on Puget Sound for marine work, at an estimated cost of $30,000. Mr. McAuliffe also stated that similar commercial stations will be established at all principal ports of the Pacific Coast.

PORTLAND, ORE.—The Public Dock Commission, foot of Stark Street, has had plans prepared for furnishing and installing equipment including ten centrifugal pumps, four electrically operated capstans, ten 100-hp., 440-volt motors, etc., for the 15,000-ton floating drydock.

BRIGHAM CITY, UTAH.—At an election held recently bonds to the amount of $200,000 were voted for rebuilding and enlarging the municipal power plant in Boxelder County.

OGDEN, UTAH.—The Mountain States Telephone & Telegraph Company contemplates improvements to its system in Ogden to consist of new aerial and underground lines at a cost of about $125,000.

FLEMING, COL.—The Board of Trustees of Fleming contemplates the construction of a municipal power plant for light and water service. The cost is estimated at about $50,000.

DEMING, N. M.—The Deming Roller Mills contemplates the installation of an electric light plant.

WAGON MOUND, N. M.—The city authorities have under consideration a proposition of A. Corey, Des Moines, Ia., who, on certain terms agrees to establish a light and power plant at this place.

Canada

FREDERICTON, N. B.—Bids will be received by the New Brunswick Hydro-Electric Commission until Sept. 21 for the construction of earth dams in connection with the development of the power projects at Shogomoc and Musquash. Bids will be receivd at a later date for dynamos, wheels, power-house construction, etc. Henry Holgate, 285 Beaver Hall Hill, Montreal, Que., is engineer.

AYTON, ONT.—R. H. Fortune contemplates the erection of an electric light and power plant to cost about $25,000. Work will be done under the direction of the Ontario Hydro-Electric Commission engineers.

Miscellaneous

BERNE, SWITZERLAND—The erection of an electric power plant to develop 350,000 hp. on St. Gothard Mountain is being planned. The cost is estimated at about $100,000,000.

Record of Electrical Patents

Notes on United States Patents

(Issued Sept. 7, 1920.)

1,351,514. FIRE ALARM SYSTEM; Simon B. Hess, New York, N. Y. App. filed April 24, 1917. Distinctive trouble signals.

1,351,518. CUTTING HOLES IN SHIP'S WALLS; Walter J. Jones, New York, N. Y. App. filed Dec. 24, 1919. Magnetic device to clamp cutter against ship.

1,351,531. AUTOMATIC TELEPHONE SYSTEM; Trygve E. Meyer, Lombard, Ill. App. filed Feb. 9, 1916. For party lines.

1,351,662. AUTOMOBILE SIGNAL; Herman Klatt, Pueblo, Col. App. filed March 24, 1919. For day or night.

1,351,684. METHOD AND APPARATUS FOR UNITING TOGETHER PIECES OF BRASS, ALUMINUM AND SIMILAR METALS OR ALLOYS BY ELECTRIC-RESISTANCE HEATING; Norbert Prostler, Berlin, Germany. App. filed May 26, 1915. Improved process.

1,351,707. INDICATOR; Michael F. Sullivan, San Francisco, Cal. App. filed Aug. 22, 1918. For street cars.

1,351,717. DUPLEX ROTARY ELECTRIC WELDING MACHINE; Joseph Ledwinka, Philadelphia, Pa. App. filed April 17, 1919. Rotary control.

1,351,724. CONDUIT SEAL; John I. Mislener, Syracuse, N. Y. App. filed June 18, 1918. Prevents accumulation of foreign substances in conduit.

1,351,729. ELECTRIC HORN; Butler Ames, Lowell, Mass. App. filed March 14, 1917. Vibrating diaphragm.

1,351,775. SYSTEM OF TRANSMITTING INTELLIGENCE; George A. Long, Hartford, Conn. App. filed Aug. 3, 1917. Telautograph.

1,351,776. OSCILLATION-GENERATOR SYSTEM; Charles V. Logwood, New York, N. Y. App. filed Feb. 21, 1917. Radio communication.

1,351,779. ELECTRIC HEATER; Alonzo C. Mather, Chicago, Ill. App. filed Nov. 25, 1918. For liquids.

1,351,787. CONDENSER UNIT AND METHOD OF MAKING THE SAME; William H. Richter, Philadelphia, Pa. App. filed July 14, 1919. Solid housing of insulating material.

1,351,788. CAR-LIGHTING SYSTEM; Harry D. Rohman, New York, N. Y. App. filed April 23, 1917. To hold steady voltage.

1,351,799. TELEPHONE SYSTEM; Frank M. Slough, Rochester, N. Y. App. filed May 15, 1915. To count connections made.

1,351,800. TELEPHONE SYSTEM; Frank M. Slough, Rochester, N. Y. App. filed March 31, 1917. Trunk operation.

1,351,815. APPARATUS FOR AND METHOD OF WELDING; Edmund J. von Henke, New York, N. Y. App. filed Jan. 18, 1919. Alternating current.

1,351,828. CAR-LIGHTING SYSTEM; William L. Bliss, Niagara Falls, N. Y. App. filed March 6, 1917. Generator-battery system.

1,351,863. TELEPHONE REPEATER; John Mills, Wyoming, N. J. App. filed Jan. 15, 1917. No singing.

1,351,876. SEMI-AUTOMATIC TELEPHONE SYSTEM; Michael Schwartz, Chicago, Ill. App. filed May 22, 1913. To indicate that called line is busy.

1,351,877. METHOD OF SEPARATING NICKEL AND COPPER FROM COPPER-NICKEL MATTES OR MATERIALS; Robert C. Stanley, New Brighton, N. Y. App. filed Feb. 5, 1919. Electrolytic.

1,351,886. ELECTROLYTIC CELL; Edward A. Allen, Portland, Me. App. filed Dec. 19, 1918. To produce chlorate of sodium or potassium.

1,351,897. ROTOR FOR DYNAMO-ELECTRIC MACHINES; George M. Eaton, Pittsburgh, Pa. App. filed Feb. 7, 1916. Current-collecting leads in shaft.

1,351,898. ROTATABLE MEMBER FOR DYNAMO-ELECTRIC MACHINES; George M. Eaton, Pittsburgh, Pa. App. filed July 12, 1917. Current-collecting leads in shaft.

1,351,907. ARRANGEMENT OF LEADS FOR DYNAMO-ELECTRIC MACHINES; Rudolf E. Hellmund, Swissvale, Pa. App. filed July 5, 1917. Prevents displacement.

1,351,909. METHOD OF AND APPARATUS FOR HEAT-TREATING METALS; Lawrence E. Johnson, Melrose, Mass. App. filed Nov. 11, 1918. For treating parts of objects.

1,351,926. COMMUTATOR; Herman R. Saxon, Toledo, Ohio. App. filed April 17, 1918. Disk type.

1,351,929. MOLD AND PROCESS FOR FORMING PORCELAIN INSULATORS THEREIN; Ernest J. Taylor, Everett, Mass. App. filed Aug. 9, 1919. For spark plugs.

1,351,975. ELECTRIC GENERATOR ATTACHMENT FOR WINDMILLS; Harry H. Taylor, Hutchinson, Kan. App. filed Aug. 5, 1919. Improved gear connection.

1,351,977. ELECTRIC FURNACE; John Thomson, Brooklyn, N. Y. App. filed Nov. 19, 1919. Thermal element of monolithic, zigzag resistance

1,351,986. HOT APPLIANCE; Hjalmar V. Barclay, New York, N. Y. App. filed May 22, 1918. Pad or bandage.

1,351,988. ELECTRICAL TESTING DEVICE; Carl L. Begas, Brooklyn, N. Y. App. filed June 8, 1918. Tests bulbs, horns, etc